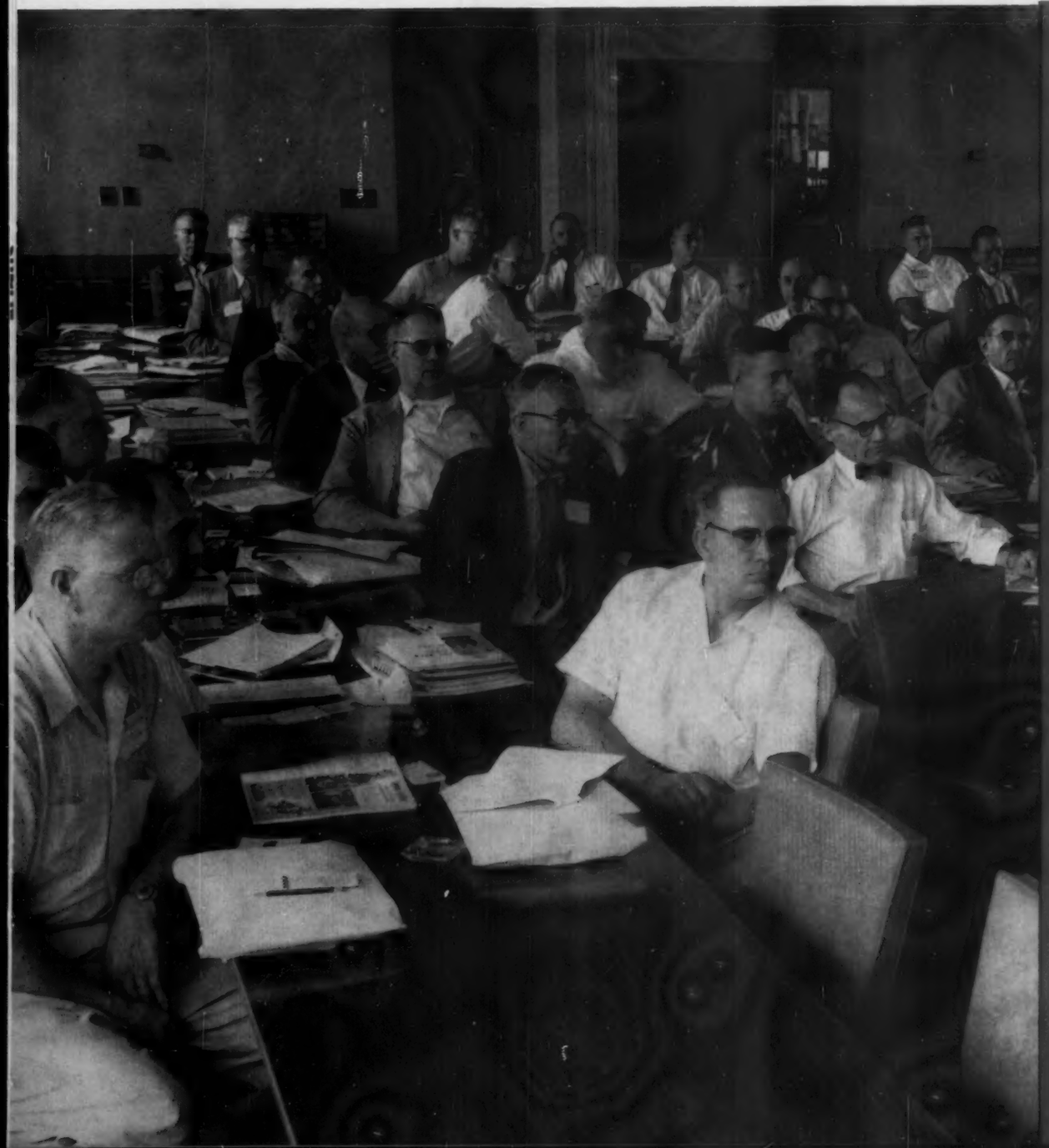
AUGUST, 1956

modern castings



Owned by
THE MEN WHO BUY

THE CO_2 PROCESS

16-page special bonus section describes latest British and American developments, and outlines recommended practices.

How to Pick a Plant Site
There's a lot more to it than the cost of transportation and land

High Strength Without Heat
Aluminum foundry uses a special alloy to make difficult castings

Metal Flow in Molds
Observations lead toward establishing general principles of gating

How I Buy Castings
Experienced purchasing agent gives some sound advice to foundrymen

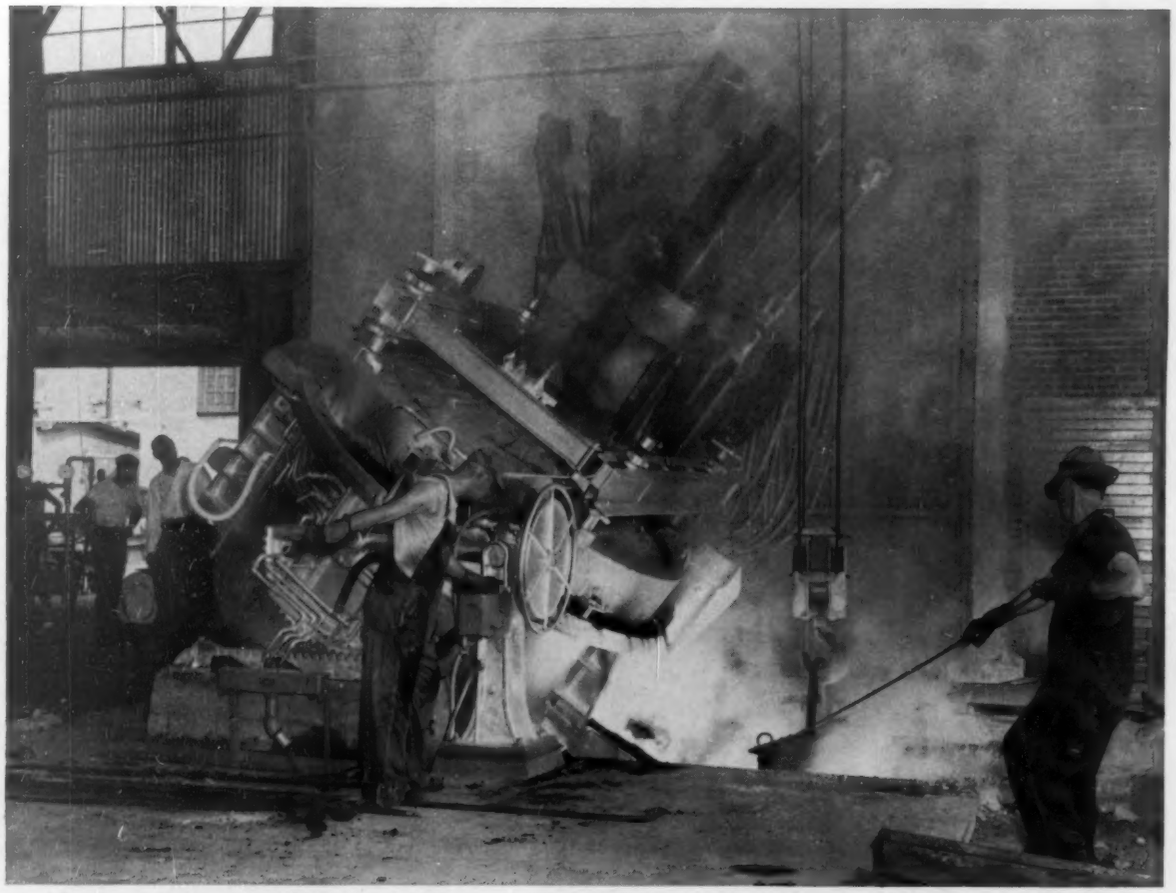
Vacuum Casting
Investment castings cost is less than twice air-melted castings

Non-Ferrous Cleaning
Small jobbing shop uses airless blast cleaning with good results

Instructors Seminar
AFS sponsors pioneering meeting for foundry, pattern making instructors

"...a wonderful piece of equipment"

says Keokuk Steel Casting Company about their Lectromelt* Furnaces



This CQT Lectromelt Furnace was recently added at their Keokuk, Iowa plant "to take care of our constantly increasing business". They had outgrown the Type Q Lectromelt furnace which they've used for many years.

Keokuk Steel Casting Company is prepared with equipment and experience to produce practically any kind of steel casting. Diversity in size, application and quantity is traditional here.

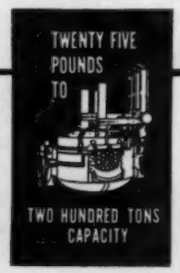
The accuracy with which metal analyses and temperatures can be controlled in a Lectromelt furnace —the speed with which metal can be prepared— contribute greatly to such success. Catalog 9-B describes Lectromelt furnaces. For a copy, write Lectromelt Furnace Company, 316 32nd Street, Pittsburgh 30, Pennsylvania (a McGraw Electric Company Division).

Manufactured in . . . ENGLAND: Birlec, Ltd., Birmingham . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa . . . JAPAN: Daido Steel Co., Ltd., Nagoya

*REG. T. M. U. S. PAT. OFF

MOORE RAPID

WHEN YOU MELT... *Lectromelt*



CIRCLE NO. 161, PAGE 19-20

future meetings and exhibits

SEPTEMBER

1-9 . . International Foundry Trades Fair and 23rd International Foundry Congress, *Dusseldorf, Germany. Hosts: Association of German Foundrymen, Industrial Association of the Foundry Industry, Foundry Machinery Trade Association, and Joint Association of German Metal Foundries.*

9-12 . . National Metal Trades Association, *Essex-Sussex Hotel, Spring Lake, N. J. Eastern Plant Management Conference.*

11-13 . . American Die Casting Institute, *Edgewater Beach Hotel, Chicago. Annual Meeting.*

16-21 . . American Chemical Society, *Convention Hall, Atlantic City, N.J. Annual Meeting.*

16-22 . . American Society for Testing Materials, *Hotel Statler, Los Angeles. Pacific Area National Meeting and Apparatus Exhibit.*

17-21 . . Instrument Society of America, *New York Coliseum, New York. 11th Annual Instrument-Automation Conference & Exhibit.*

24-25 . . Steel Founders' Society of America, *The Greenbrier, White Sulphur Springs, W. Va. Fall Meeting.*

24-26 . . Material Handling Institute. *The Greenbrier, White Sulphur Springs, W. Va. Fall Meeting.*

25-28 . . Association of Iron and Steel Engineers, *Public Auditorium, Cleveland. Iron and Steel Exposition.*

27-29 . . National Association of Foremen, *Jefferson Hotel, St. Louis. Annual Meeting.*

OCTOBER

4-5 . . Magnesium Association, *Drake Hotel, Chicago, Annual Convention.*

6-12 . . American Society for Metals, *Public Auditorium, Cleveland. National Metals Congress & Exposition.*

8-12 . . American Welding Society, *Hotel Cleveland, Cleveland. Fall Technical Meeting.*

11-12 . . National Foundry Association, *Sheraton-Cadillac Hotel, Detroit. Annual Meeting.*

11-12 . . Armour Research Foundation, Illinois Institute of Technology, *Hotel Sherman, Chicago. National Noise Abatement Symposium.*

18-20 . . Foundry Equipment Manufacturers' Association, *The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.*

20-23 . . Conveyor Equipment Manufacturer's Association, *The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.*

22-26 . . National Safety Council, *Conrad Hilton, Congress, Morrison, and LaSalle Hotels, Chicago. Safety Congress & Exposition.*

25-26 . . Metals Casting Conference, *Purdue University, Lafayette, Ind.*

29-30 . . Refractories Institute, *The Homestead, Hot Springs, Va. Fall Meeting.*

31-Nov. 2 . . Gray Iron Founders' Society, *The Homestead, Hot Springs, Va. Annual Meeting.*

31-Nov. 2 . . Industrial Management Society, *Hotel Sherman, Chicago. Time and Motion Study and Management Clinic.*

NOVEMBER

7-9 . . Steel Founders' Society of America, *Carter Hotel, Cleveland. Technical & Operating Conference.*

8-9 . . All-Canadian Foundry Conference, *Mount Royal Hotel, Montreal, Que. Sponsored by Eastern Canada and Ontario Chapters of the American Foundrymen's Society.*

25-30 . . American Society of Mechanical Engineers, *Hotel Statler, New York. Annual Meeting.*

26-30 . . Third International Automation Exposition, *Trade Show Bldg., New York.*

29-30 . . Michigan Regional Foundry Conference, *University of Michigan, Union Bldg., Ann Arbor, Mich. Sponsored by the Detroit, Saginaw Valley, Central Michigan, and Western Michigan Chapters of the University of Michigan and Michigan State University Student Chapters of the American Foundrymen's Society.*

DECEMBER

5-7 . . American Institute of Mining and Metallurgical Engineers, *Morrison Hotel, Chicago. Electric Furnace Steel Conference.*

1957

FEBRUARY

4-8 . . Gray Iron Founders' Society, *Benjamin Franklin Hotel, Philadelphia. Committee Week and Spring Meeting.*

MARCH

25-29 . . American Society for Metals, *Pan-Pacific Auditorium, Los Angeles. Tenth Western Metal Exposition and Congress.*

MAY

6-10 . . American Foundrymen's Society, *Cincinnati. Castings Congress.*

FEDERAL

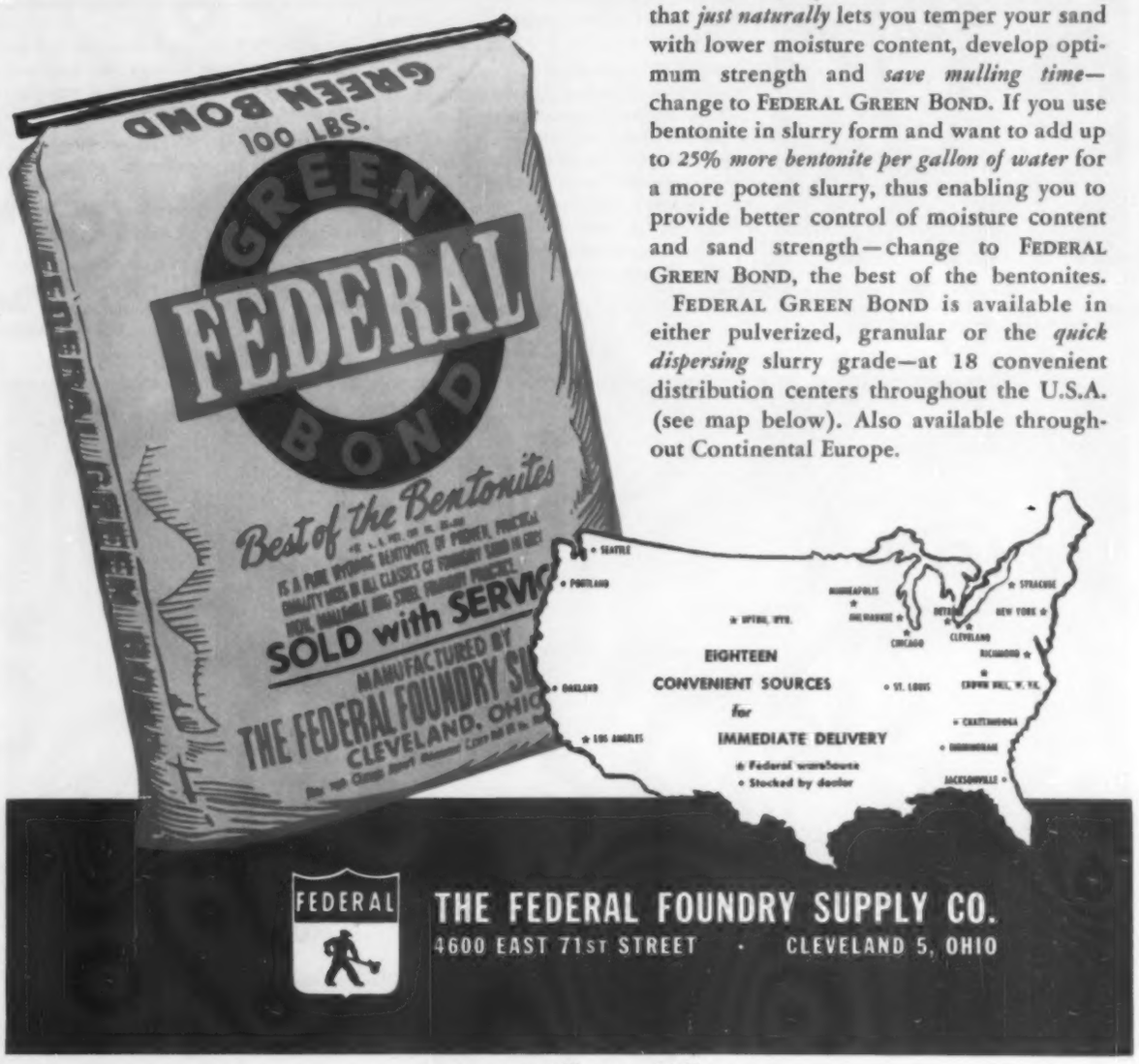
GREEN BOND ...THE ONLY BENTONITE WITH "NATURAL" LOW VISCOSITY

Low viscosity is a *natural characteristic* of the bentonite clay from which FEDERAL GREEN BOND is produced — *not* a property acquired through adding certain chemicals. FEDERAL engineers "test-drill" bentonite deposits *before* mining — select only those lots with a *natural low viscosity* for production of FEDERAL GREEN BOND.

FEDERAL GREEN BOND is a pure mineral product—*unadulterated, untreated.* It contains no chemicals or other ingredients detrimental to foundry sands or conditions. Its low viscosity, its ability to develop and control HIGH green and dry bond strength, its exceptionally high Ph rating (9.0) and its unerring uniformity are inherent qualities that just "come naturally" in FEDERAL GREEN BOND.

Therefore, if you want to use a bentonite that *just naturally* lets you temper your sand with lower moisture content, develop optimum strength and *save mulling time*—change to FEDERAL GREEN BOND. If you use bentonite in slurry form and want to add up to *25% more bentonite per gallon of water* for a more potent slurry, thus enabling you to provide better control of moisture content and sand strength—change to FEDERAL GREEN BOND, the best of the bentonites.

FEDERAL GREEN BOND is available in either pulverized, granular or the *quick dispersing* slurry grade—at 18 convenient distribution centers throughout the U.S.A. (see map below). Also available throughout Continental Europe.



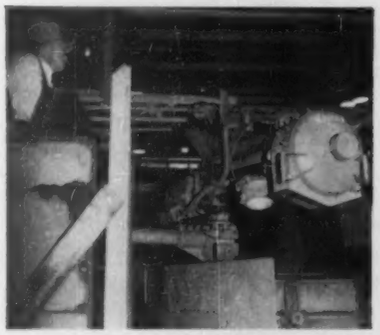
CIRCLE NO. 162, PAGE 19-20

A Progress Report at Fairbanks, Morse-Kansas City

A year and a half of operation at F-M's new Kansas City foundry provides a story of production efficiency

THE new foundry of Fairbanks, Morse & Co. at Kansas City, Kansas, is actually made up of four separate foundries. Gray iron castings are produced in three of these areas while non-ferrous and stainless steel castings are produced in a fourth.

In designing the plant, the requirements of each class of work received full consideration. Thus, the equipment for the production of the very light work is considerably different than that used for the heavier work. However, the entire mulled sand requirement of the plant is handled by Speedmullors.



A close-up of the Hydra Slinger and its operator. Over two-hundred-twenty deep 38 x 42 inch molds are rammed on each shift.

FIVE SPEEDMULLORS prepare all of the molding and core sand in the foundry to FM's exact specifications. Two Model "80A" Speedmullors handle all of the molding sand for the light and intermediate molding units. Three smaller Speedmullors are used for the heavy molding unit, the non-ferrous and stainless steel foundry, and the core room.

One of the Model "80As" thoroughly mulls and cools *over three-hundred-fifty tons of molding sand on each eight hour shift.* Up to 395 batches are prepared on each shift and specifications are held exactly from batch to batch. The total mulling cycle for this mullor is only sixty-seven seconds including batch injection, mulling, cooling and discharge. Mulltrolmatic controls handle the cycle timing with precision.

These sand requirements are made necessary by the great ramming capacity of the Super Hydra Slinger supplied with mulled sand from this mullor. This slinger rams over two-hundred-twenty deep 38 x 42 inch molds on each eight-hour shift. This large work is handled on a B & P Roto-Mold turntable of special design. Even with this high production, patterns can be changed on this table in moments . . . that's real flexibility.

THE HYDRA-SLINGER rammed molds are rolled over and drawn from the patterns on a single B & P 1020 RCX Rol-A-Draw machine.

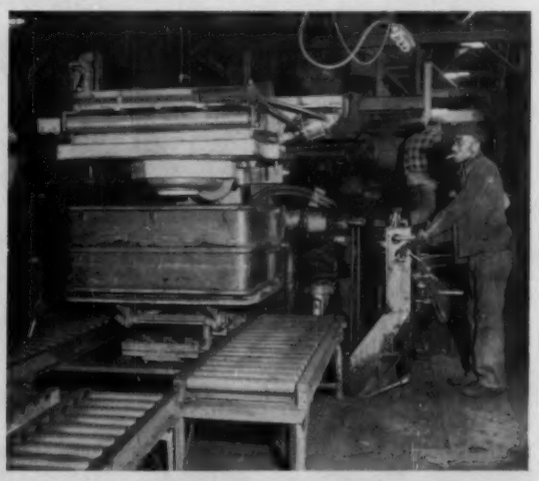
B & P M-alloy tips and liners are used exclusively on FM's slingers. Here an M alloy liner is reversed.

Fast accurate operation is essential, and important Rol-A-Draw features like automatic cycle control and automatic flask equalization make all the difference.

Another slinger on FM's heaviest work is also supplied with Speedmullor mulled sand. On this unit, molds up to 60 x 60 inches in size are rammed. Approximately fifty or sixty molds are rammed on each shift.

THE FULL STORY of this outstanding plant was recently featured in Better Methods magazine. A copy of this completely illustrated article will be sent on request. Use the reader service card in this publication.

One of these Model "80A" Speedmullors fully mulls over 350 tons of molding sand to exact specification on each shift.



All of the Hydra Slinger rammed molds made on the Roto-Mold unit are quickly rolled over and precisely drawn on this B & P Rol-A-Draw.

LOOK TO BEARDSLEY & PIPER FOR BETTER METHODS
THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FOUNDRY MACHINERY
CIRCLE NO. 163, PAGE 19-20

GIFS Holds Area Meet

"You cannot inspect quality into your castings; it must be there to begin with." This point was stressed by GIFS Technical Director C. F. Walton before a group of 36 foundrymen attending a joint meeting of the Chicago Area Management Group and the Wisconsin Area Management Group, June 19, at Hank's Restaurant, Waukegan, Ill. C. R. Lindgren, Lindgren Foundry Co., Batavia, Ill., president of the Chicago Area Management Group, in opening the meeting called on E. H. Mitchell, field director of GIFS who expressed regrets that Don Workman, executive vice-president, could not attend because he was in Washington on the critical scrap metal shortage situation.

Mitchell stated that there are 22 local GIFS management groups throughout the country and that additional groups are now forming. New members are also coming into the society as a result.

Richard C. Meloy, newly-appointed to the staff of GIFS as marketing director, it was brought out, will embark on an energetic program of assisting members in marketing of castings. Plans are now being formulated to broaden the uses and sales of gray iron castings through latest marketing techniques.

Walton, speaking on "What Your Customer Really Wants" stressed that the customer considers price, delivery, quality, and service, in that order. Foundrymen, however, must consider service of greatest importance and price of least consideration of the four factors mentioned. The society is now preparing a *Gray Iron Handbook* scheduled to be off the press early in 1957.

ASTE Elects Chiefs

The American Society of Tool Engineers climaxed its annual meeting and exhibit in Chicago with election of officers Howard C. McMillen, Seeger Refrigerator Co., was named president.

Other officers are: H. E. Collins, first vice-president; G. A. Goodwin, second vice-president; Wayne Ewing, third vice-president; and H. Dale Long, fourth vice-president; and John X. Ryneska, treasurer.

august, 1956
vol. 30, no. 2

modern castings

in this issue

BONUS SECTION

How New Jersey Looks At Air Polution Problem / H. J. Weber 22
What About Investment Cast Vacuum Alloys? / Ken Iverson 24
Announce 1957 AFS Castings Congress 27
More on Metal Flow in Molds / Goro Ohira 28
Foundry Education Takes Pioneering Step at AFS Seminar 30
What the Purchasing Agent Said to the Foundryman / R. H. Webb 32
The CO_2 Process 33
What to Look For in a Plant Site / James R. Allen 49
How a Non-Ferrous Job-Shop Cleans Castings 54
Technical Committees Chart Course for '57 55
Aluminum Foundry Gets High Strength Without Heat Treatment / Arthur Van Newkirk 56
AFS Chapter Officers Confer 58
Foundry Facts—Sand / Technological Principles 61

regular departments

Future Meetings & Exhibits ..... Inside Front Cover
Products & Processes 4
Let's Get Personal 15
Foundry Trade News 59
For The Asking 63
Casting Through the Ages 73
Obituaries 74
Local Foundry News 76
AFS Chapter Meetings 77
Classified Advertising 79
Advertisers and Their Agencies 80

FOUNDRY TECHNICAL CENTER, Golf & Wolf Roads, Des Plaines, Ill.
VAnderbilt 4-0181

WM. W. MALONEY, *General Manager*
CURTIS G. FULLER, *Managing Director*

PAUL R. FOGHT, *Managing Editor*
GEORGE A. MOTT, *Technical Writer*

J. M. ECKERT, *Advertising Manager*

Associate Editors

HANS J. HEINE, *Metallurgical*
H. J. WEBER, *Safety, Hygiene, and Air Pollution Control*
J. E. FOSTER, *Engineering*
A. B. SINNETT, *Education*

Branch Offices

Cleveland—14805 Detroit Ave., BOulevard 2-2423, WM. I. ENGLEHART, *District Manager.*
Dallas—2831 El Capitan Davis 7-3630, RICHARD HOIERMAN *District Manager*
New York—6 East 39th St., MUrray Hill 5-9450, RICHARD WESTON, *District Manager*

MODERN CASTINGS is indexed by Engineering Index, Inc., 29 West 39th St., New York 18, N. Y. and microfilmed by University Microfilms, 313 N. First St., Ann Arbor, Mich.

Published monthly by the American Foundrymen's Society, Inc., Golf & Wolf Roads, Des Plaines, Ill. Subscription price in the U.S., Canada and Mexico $3.00 per year; elsewhere, $6.00. Single Copies 50c. May and June issues $1.00. Second-class mail privileges authorized at Pontiac, Illinois. Additional entry at Des Plaines, Ill.

AUDITED PAID CIRCULATION ABC

HOW'S BUSINESS?

It Looks Mighty Good

Despite all the calamity howling of recent months, the evidence supports a continuation of present high levels of business activity for at least the immediate future. This appears to be especially true of sales of foundry plant and equipment.

It's been a favorite practice in recent months for many persons to wail that business is poor and that even where it's good the handwriting is on the wall. This just isn't so. It is true that some businesses are off and some areas are weak, but even the automotive industry isn't down as much as popularly assumed and farm income has actually taken a turn for the better.

Forecasting the future is a mighty risky thing and we know better than to try it but it's high time we all understood what is going on right now.

Capital expenditures throughout 1956 have been higher than in 1955. For the third quarter of this year they are about 25 per cent higher than for the same period of last. Part of this increase is due to higher prices but most of it is due to heavier purchases of goods.

Just where is this tremendous gain coming from?

Well, manufacturing is very strong. The upsurge is dominated by expenditures in durable goods manufacturing. Outlays in the first nine months of this year, according to the U.S. Department of Commerce, will run 40 to 80 per cent over those of the same period of 1955 in many broad fields.

It happens that the primary metals group, which includes foundries, is one of the groups to show a tremendous increase — better than a 65 per cent gain in capital expenditures for the first nine months of this year over last!

Unfortunately, figures for foundries alone are not available but for the primary metals group as a whole, which includes the foundries, expenditures for capital goods in the first nine months look something like this:

Primary iron and steel	$904 million
Primary nonferrous metals	$290 million
Total	$1,194 million

New foundry equipment orders as reported by the *Survey of Current Business* cover only part of the industry and figures are available for only the first four months. They show about a 27 per cent gain for that period. When the results of the AFS Castings Congress in May are included the gain will obviously be greatly increased.

It's no wonder that the recent mid-year Press Symposium of the Chamber of Commerce of the United States concluded that 1956 should be the best business year yet!

99.9% PURE SILICA
WEDRON
SILICA COMPANY
INDUSTRIAL SAND

WEDRON
SILICA SANDS

Best for Foundry Use

Sand was once a pretty simple thing. You just dug it up and shipped it to people who needed it. That was O.K. some years ago, but sand like everything else has changed. High precision casting requires sands of specific grain sizing.

Wedron spends many thousands of dollars annually for new equipment, new processes, experimentation and testing for quality control.

Because of this, you're sure of *uniformity*, *purity* and *smooth rounded grains* that eliminate cutting out of core boxes.

With Wedron sand you get the right sand for every casting need:

—fine grades for shell molding

—coarser grades for standard casting methods

—blasting sand

—the finest and purest silica flour

MINES AND MILLS IN THE OTTAWA-WEDRON DISTRICT

WEDRON SILICA COMPANY

135 SOUTH LASALLE STREET, CHICAGO 3, ILLINOIS

CIRCLE NO. 164, PAGE 19-20

products and processes

Binder for the CO_2 process has a silicate base but is in liquid form; it gives top hardness and strength with easy ramming and fast gassing. DonCO_2 binder fits a wide variety of work. *Eastern Clay Products Dept., International Minerals & Chemical Corp.*

CIRCLE NO. 1, PAGE 19-20

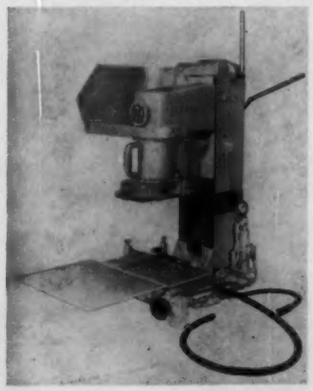
Portable band saw for wood, metal, plastics, etc., has built-in motor. Total weight is 15 lb. Model B-240 Tote-Saw has 12" throat, 2-speed drive, adjustable blade guard and guide. *Burgess Vibrocrafters Inc.*

CIRCLE NO. 2, PAGE 19-20

Dust collector of the wet type works on the venturi principle. Water does the scrubbing. No spray nozzles, no water pump, no separate settling tank. Compactness is a big feature of the Ventrijet. *Pangborn Corp.*

CIRCLE NO. 3, PAGE 19-20

Bench-type core blower with extended draw has fast cycle. The CB5CDH has full 4" draw. One control does it all: a palm push-button. Takes horizontally split as well as one-piece core boxes. *Beardsley & Piper Div., Pettibone Mulliken Corp.*

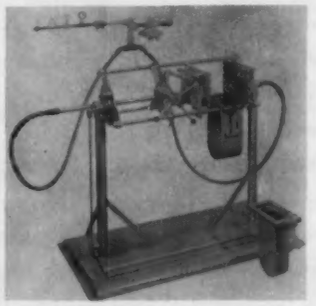


CIRCLE NO. 4, PAGE 19-20

Saw blade with carbide tips comes in several diameters and tooth arrangements. Alternate double-beveled and straight raker teeth give long life and smooth cuts. *W. F. Meyers Co.*

CIRCLE NO. 5, PAGE 19-20

Shell core unit is reported "ideal" for long runs and flexible enough for short runs. It makes intricate cores up to 6" diameter by 14" long at a rate of one per minute. Air and gas controls are furnished. Core thickness is controlled by length of time invested. *Dependable Pattern Works.*



CIRCLE NO. 6, PAGE 19-20

Tube furnace has a 4KW electric resistance element, holds a combustion tube up to 3" OD at max temperature of 2750 F. Easily modified to high-temp pot furnace. Power service: 230 v, 60 cps; control circuit, 115 v, 60 cps. Eight heating elements run the CF-4SA furnace. *Lindberg Engineering Co.*

CIRCLE NO. 7, PAGE 19-20

Clamshell bucket line has a new addition: the XLR-38, a 3/8 cu yd light rehandler for 6 to 12-ton equipment. Comes with or without teeth and counterweights. *Erie Strayer Co.*

CIRCLE NO. 8, PAGE 19-20

Low-toxic hardeners for use with epoxy tooling compounds are nondermatitic. Hardener 946 has pot life of 10 to 15 minutes; hardener 986 last 25 to 30 minutes at ambient temperatures. *Furane Plastics, Inc.*

CIRCLE NO. 9, PAGE 19-20

Additive for chromium plating called CPA 1800 reportedly simplifies, speeds, and improves chrome plating operations. *Chromium Chemicals Div., Diamond Alkali Co.*

CIRCLE NO. 10, PAGE 19-20

Foundry fork truck has been specially designed for handling ingots. The pig hand lift truck accommodates leg

clearances under 2", handles 200-lb loads. Hydraulic operation and small overall size. *Market Forge Co.*

CIRCLE NO. 11, PAGE 19-20

Epoxy resin and glass cloth combine to make patches that withstand over 1000 psi for extended periods. The resin is called Sonite. Patches are simple and fast to apply, and invaluable where welding is inadvisable. *Smooth-On Manufacturing Co.*

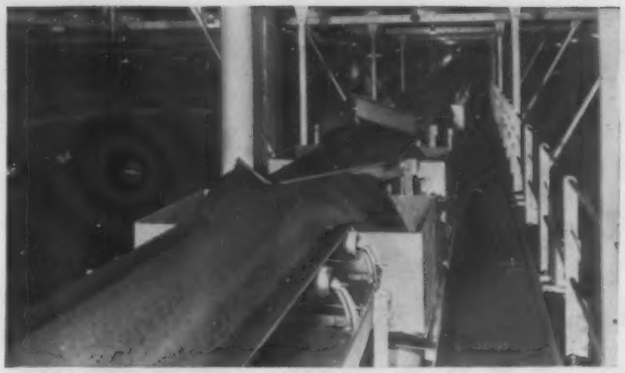
CIRCLE NO. 12, PAGE 19-20

Mobile crane designated model KE can handle 10,000 lbs, is designed to move any shape load that can be put under its boom, inside the plant or out. Features include auto-

mobile-type controls, excellent visibility, many optional accessories to add to its versatility. *Hyster Co.*

CIRCLE NO. 13, PAGE 19-20

Control valve for improving air suction systems and dust collectors has two outstanding features: automatic



Jeffrey Sand Handling Belt Conveyor with Automatic Plows

Jeffrey Universal Mold Conveyor

Jeffrey Universal Mold Conveyor, Automatic Mold Dumper and Apron Conveyor

Jeffrey Apron Conveyor Handling Castings

CIRCLE NO. 165, PAGE 19-20

you'll see the difference in foundries planned by **JEFFREY**

MECHANIZATION takes over many operations formerly requiring manpower—from sand preparation and distribution to the molders and core makers, to the pouring positions and shakeouts, then back to sand reclaiming and storage—moving raw materials and processing finished castings. Jeffrey services to the foundry industry are that complete.

We'll start with a survey, prepare layouts and recommend equipment, build and install a system to suit your exact requirements. We'll alter existing facilities or replace obsolete units with modern, efficient Jeffrey machinery.

Catalog 845 describes these services and equipment. For a copy, write to The Jeffrey Manufacturing Company, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

SCIENTIFICALLY DEVELOPED . . LABORATORY CONTROLLED FOUNDRY PRODUCTS

FOR STEEL..GRAY IRON
MALLEABLE AND NON-FERROUS

DELTA
SUPERKOAT
WASH

COVERS A GREATER
SURFACE AREA..PRODUCES
SMOOTHER..CLEANER
CASTINGS... *at lower cost!*

Delta Superkoat Wash is recommended for Steel, Gray Iron, Malleable and Non-Ferrous castings. It's easy to mix and apply uniformly to green or dry sand and baked surfaces by dipping, swabbing, spraying or brushing.

NOTE THESE IMPORTANT ADVANTAGES OF DELTA SUPERKOAT WASH:

1. **NO PRECIPITATION OR SETTLING —** When thoroughly mixed, wash will stay in suspension indefinitely.
2. **EASY TO APPLY —** It can be dipped, swabbed, brushed or sprayed on green or dry sand and baked surfaces.
3. **RAPID, DEEP PENETRATION AND EXCELLENT ADHESION** Quickly anchors itself 5 to 7 grains deep in sand surfaces.
4. **NON-REACTIVE — LOW GAS —** Will not react or produce gas in contact with molten metal.
5. **REDUCED CLEANING COSTS —** Cast surfaces are smoother and castings are cleaner.
6. **WILL NOT FLAKE —** When completely dried, the wash is thoroughly bonded to the sand surfaces.
7. **HIGHLY REFRACTORY —** Has an unusually high fusion point.
8. **ELIMINATES SAND FUSION AND BURN-IN —** Flowing metal will not crack or rupture wash during pouring.
9. **ECONOMICAL TO USE —** Covers a greater surface at a lower cost per pound of wash.

Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

DELTA

DELTA OIL PRODUCTS CO.
MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

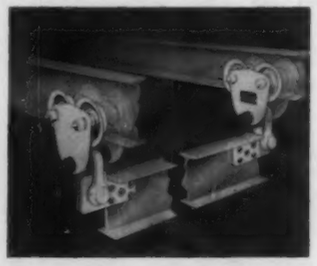
MILWAUKEE 9, WISCONSIN

CIRCLE NO. 166, PAGE 19-20

operation, and absolutely unobstructed air stream passage to eliminate clogging. Handles 3 to 8" openings. *The Kindt-Collins Co.*

CIRCLE NO. 14, PAGE 19-20

Crane kit lets you build a push-type underhang bridge crane for less than $100. "Budgit" kit, spans



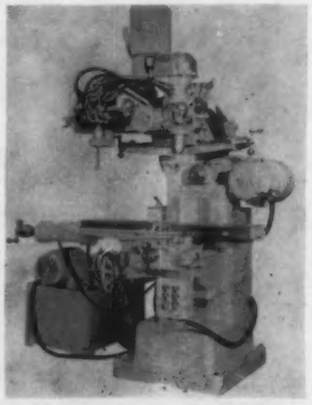
up to 25', supports to 2000 lb. You install it on your own I-beam in less than two hours, the maker says. *Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc.*

CIRCLE NO. 15, PAGE 19-20

Concrete saw sports a neat 36 hp to chew through 25 fpm. Target 360 Automatic has good control setup, extreme ruggedness, six solid wheels on the ground for stability and straight cutting. Depth of cut can be controlled while saw is in motion. *Robert G. Evans Co.*

CIRCLE NO. 16, PAGE 19-20

Milling machine will mill, jig-bore and duplicate in three dimensions. Model 10RH has reversible ram turret with all-angle spindle head at one end and slotting head at the



other, converts in a few seconds. Stylus pressure of 4 oz reproduces metal, plastic or wood masters. *Axelson Manufacturing Co.*

CIRCLE NO. 17, PAGE 19-20

String buffs for industrial polishing come in most popular sizes. Two big advantages are tough endurance and

gentle surfacing action. Good on most soft alloys as well as chrome and steel. *Schlegel Co.*

CIRCLE NO. 18, PAGE 19-20

Anti-bridging discs keep products free-flowing in these bins. Built and shipped in sections, they go up without field riveting or skilled help. Ca-

pacity can be increased at any time by adding extra sections. Steel walls are fireproof, vermin proof, plenty sturdy. *Day Co.*

CIRCLE NO. 19, PAGE 19-20

Heat-resistant paint stays on at temperatures to 600 F. Known as Heat-Rem QD Black, it air dries to a tough, bright finish in under 2 hours. No special baking, no objectionable odor; goes on by brush or spray, resists smoke, moisture, fumes, acids and alkalis as well. *Speco, Inc.*

CIRCLE NO. 20, PAGE 19-20

Pocket calculator makes a snap out of such operations as multiplication, division, percentages, square roots, equation solving. The Curta Calcula-

tor works much like a large desk job and handles big figures. Real simple to use. *Utility Supply Co.*

CIRCLE NO. 21, PAGE 19-20

Electronic potentiometer comes with pneumatic transmitter which sends a 3-15 psi signal proportional to the measured variable. It measures

He has to see for himself!

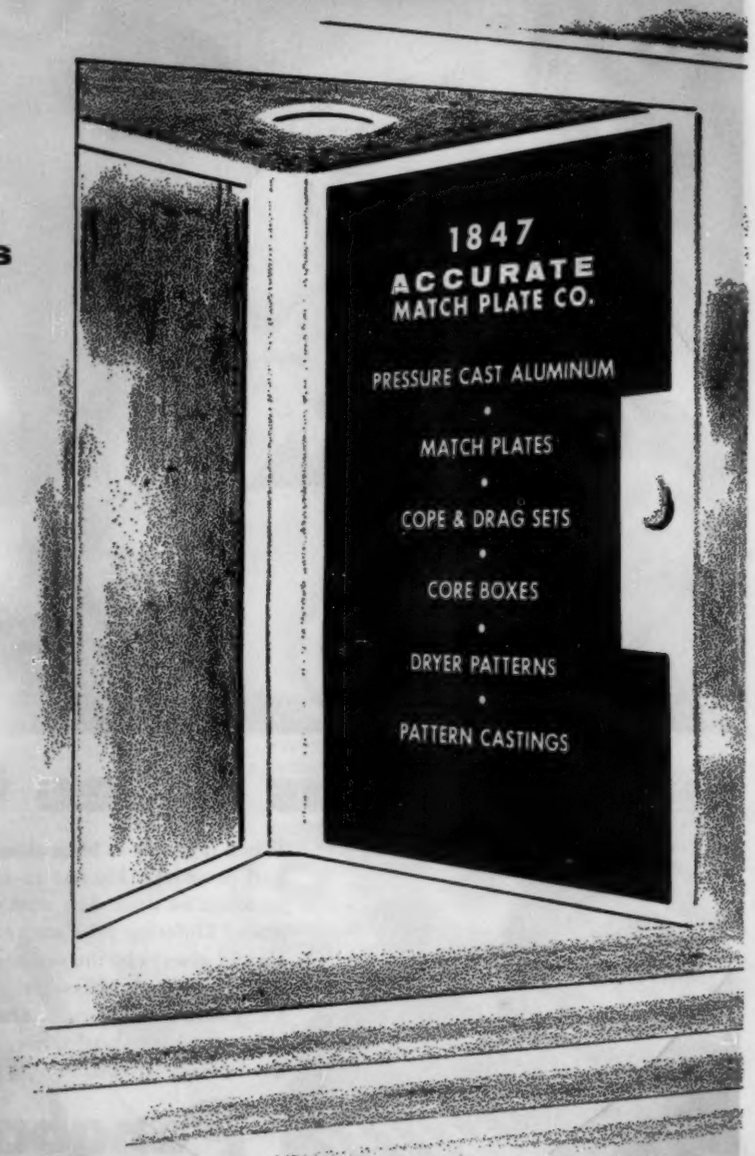
When it comes to blast cleaning, a foundryman can't believe claims and promises. He has to see for himself the kind of cleaning job an abrasive does. His next question is: What does it cost in operation? Different jobs may require different abrasives but the result should always be the same—the *best* job at *lowest cost.* Malleabrasive and Tru-Steel abrasives give you that. Whichever you need, Pangborn has the right abrasive for your job. Talk to one of our sales engineers or write PANGBORN CORP., 1300 Pangborn Blvd., Hagerstown, Maryland.

Pangborn DISTRIBUTORS FOR **MALLEABRASIVE®** AND **TRU-STEEL SHOT**

3A

CIRCLE NO 167, PAGE 19-20

Open the Door to Greater ACCURACY



AREA REPRESENTATIVES

AUBURN, MASS.
Henry A. Kottmann
Telephone: Terrace 2-2683

MILWAUKEE, WIS.
John M. Donohue
Telephone: Hilltop 2-7130

LOS ANGELES, CALIF.
McGowan Company, Inc.
Telephone: Angelus 3-7575

WRITE FOR PRICE SHEET

ACCURATE MATCH PLATE CO.
1847 W. CARROLL AVE. • CHICAGO 12, ILLINOIS

CIRCLE NO. 168, PAGE 19-20

speed, viscosity, pH, resistance, smoke density, conductivity, flow, pressure, temperature. *The Bristol Co.*
CIRCLE NO. 22, PAGE 19-20

In-plant ambulance is electrically driven for swift, silent operation. Holds driver, nurse, patient, stretcher, oxy-

gen equipment, etc. Three-wheel design of Westcoaster ambulance gives great maneuverability. Good springs. *West Coast Machinery, Inc.*
CIRCLE NO. 23, PAGE 19-20

Little cart is good for moving small parts, chips, cutoffs, liquids. Called Model 47, its over-all height is 20" for clearance under work benches, etc. It weighs 95 lbs and holds 7 cu. ft. *Coolant Equipment Corp.*
CIRCLE NO. 24, PAGE 19-20

Skin cream containing 77% silicone protects hands against acids, alkalis, oxidizing agents, salts, detergents, antibiotics, etc. Name: Siliconex. A little goes a long way, too. *Hygiene Research, Inc.*
CIRCLE NO. 25, PAGE 19-20

Abrasive cut-off machine can be lifted off its stand by crane and used as swing cut-off unit on gates and

risers. Model CAC-16 takes a 5 to 7½ hp motor; plenty of safety guards furnished. *Max Mfg. Co.*
CIRCLE NO. 26, PAGE 19-20

Plastic ducts are reinforced with polyester glass for lightness, toughness, high strength, chemical resist-

ance. Wide range of standard ducts and fittings, round and rectangular in section. *Haveg Industries, Inc.*

CIRCLE NO. 27, PAGE 19-20

Lift truck line features diesel engines as standard equipment. Lower fuel consumption and long engine life are

among the advantages. The 6000 and 8000-lb models have the Perkins P4 diesel; lighter units have the Waukesha 180 DLC. Both are 4-cylinder diesels. *Hyster Co.*

CIRCLE NO. 28, PAGE 19-20

Pyrometer gives accurate measurement of heated gas from 0 to 2900 F. Called the Land suction pyrometer, it forces hot gas past the thermocouple to increase convective heat transfer. Recommended for uptakes and regenerators of open hearth furnaces, similar operations. *Fielden Instrument Div., Robertshaw - Fulton Controls Co.*

CIRCLE NO. 29, PAGE 19-20

Power unit for electric trucks includes a permanent charger that can give the battery a boost any time the

truck isn't in actual use. It just plugs into a standard 60 cps outlet. No danger of overcharging with the Complete Power Unit. *K-W Battery Co.*

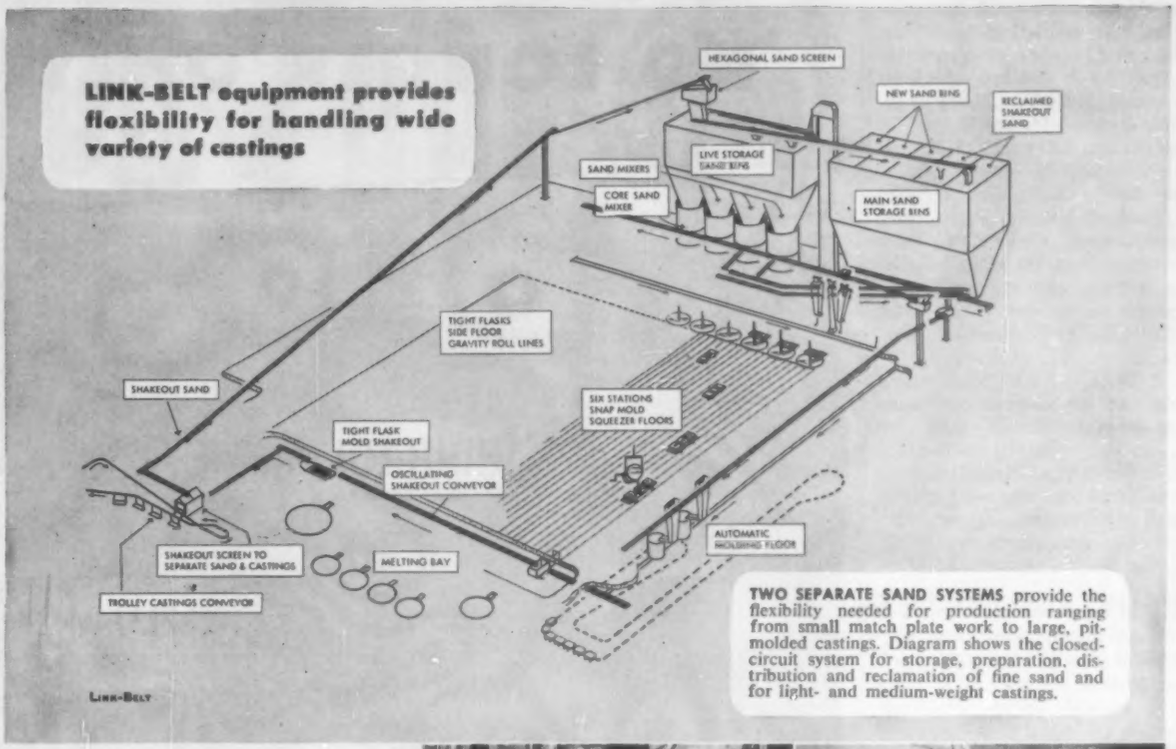
CIRCLE NO. 30, PAGE 19-20

Control valves to JIC standards are called the Speed King series. They're solenoid pilot-operated valves, report-

General Metals jobbing foundry approaches

full mechanization

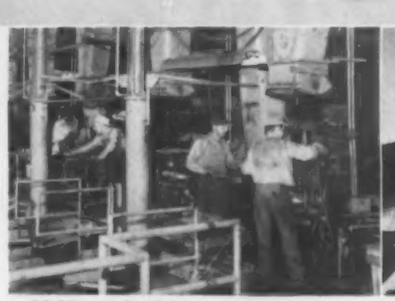
LINK-BELT equipment provides flexibility for handling wide variety of castings



TWO SEPARATE SAND SYSTEMS provide the flexibility needed for production ranging from small match plate work to large, pit-molded castings. Diagram shows the closed-circuit system for storage, preparation, distribution and reclamation of fine sand and for light- and medium-weight castings.

THE variety of castings produced by job shops multiplies handling problems. But the Oakland (Calif.) plant of General Metals Corp. proves that mechanization is both possible and practical. Here Link-Belt equipment—including special machinery designed specifically for this installation—speeds production of castings ranging from one pound to seven tons. Other benefits include minimized manual handling, improved working conditions.

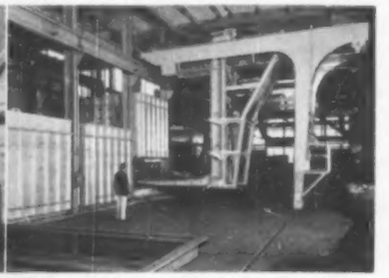
Link-Belt engineers can plan an entire conveying and sand preparation system for you . . . and follow through with a complete line of equipment to help you produce better castings at lower cost. For one machine or complete engineering, call your nearest Link-Belt office. For complete information, write for Book 2423. 14.207



Molds are loaded onto cars, which are rotated 90 degrees on turntable and run off on tracks to pouring and storage line.

Semi-automatic device dumps sand and castings onto oscillating conveyor. Cars return by gravity to molding stations.

Castings drop from shakeout screen to trays of overhead trolley conveyor for delivery to cleaning bay.



Unique Link-Belt "Manipulator" carries up to eight tons of castings to annealing ovens, quench tanks or storage.

LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

CIRCLE NO. 169, PAGE 19-20

ed to last through 25 million cycles under normal conditions, and can handle over 600 cycles per minute. *Valvair Corp.*

CIRCLE NO 31, PAGE 19-20

Totally enclosed motor is fan-cooled, features double-end ventilation system. Slot cell insulation is Mylar. Comes in wide range of speeds in ratings from 50 to 200 hp, with larger sizes on special order. *Delco Products Div., General Motors Corp.*

CIRCLE NO. 32, PAGE 19-20

Dragline trucks have welded steel frames, hardwood decks. Wide range of capacities and deck sizes. Deck heights range from 7½ to 14". Roller bearing wheels are standard, with steel, plastic or rubber tires. *Howe Scale Co., Materials Handling Div.*

CIRCLE NO. 33, PAGE 19-20

Masonry saw line now comes powered by 2-hp, continuous duty, fan cooled, totally enclosed motor. Extra power (to 5½ hp in intermittent service) gives these masonry saws greatly improved performance. *Clipper Manufacturing Co.*

CIRCLE NO. 34, PAGE 19-20

Contact thermometer combines surface contact thermocouple and indicating meter damped for quick reading—one second touch is all it takes to get an accurate figure. Probes are available to 60" with scale calibrated over its 0-650 F range in both F and C. Many other useful features. *Royco Instruments.*

CIRCLE NO. 35, PAGE 19-20

Shipping box folds into one-fifth of its original size for returning. It's made of corrugated steel, can be stacked loaded or unloaded, and has no removeable parts. Well suited for fork truck handling. *Pressed Steel Div., Republic Steel Corp.*

CIRCLE NO. 36, PAGE 19-20

Two-wheel hand truck comes in either straight back style for boxes, crates, and bags; or concave back style for drums, barrels, etc. Both styles come in two sizes: 18" wide by 42" high, and 20" by 48". Nose plate extends 7" for easy pickup. Heavy angle iron frame. *Palmer-Shile Co.*

CIRCLE NO. 37, PAGE 19-20

Abrasive blade line has two new additions: CBR-922 for certain refractories (including insulating brick), and Tuffie 103 for unusually hard

CIRCLE NO. 170, PAGE 19-20

NO LONGER ONLY FIVE...BUT

LINOIL
CORE OIL

INDUCTOL
FAST BAKE CORE OIL

FREFLO
PARTING COMPOUND

LIN·O·CEL
SAND STABILIZER

ADMIREZ
FOUNDRY RESIN

Archer

Daniels

Midland

company

FOUNDRY
PRODUCTS DIVISION
2191 WEST 110th ST.
CLEVELAND 2,
OHIO

Seven Top Performers!

Foundrymen who like to see well-balanced core room operations will put their seals of approval on two newcomers to the Archer quality line of sand additives... LIN-O-SET and ADCOSIL.

Why not get these top performers into the act saving production dollars in your foundry? Write for technical bulletins.

materials like high-fired refractories. *Eveready Briksaw Co.*

CIRCLE NO. 38, PAGE 19-20

Flooring material called Corocrete tests out 5 to 6 times more resistant to abrasion than concrete. Two types are available; both resemble concrete, are acid proof, take human traffic in 8 hours, normal plant traffic in 24 hours. *Ceilcote Co.*

CIRCLE NO. 39, PAGE 19-20

Lifting hook designed for heavy chores such as handling hot ladles is pneumatically operated, electrically controlled. Two sizes, 6 and 12 tons. Jaws overlap in closing and cannot open when loaded. *Gar-Bro Manufacturing Co.*

CIRCLE NO. 40, PAGE 19-20

Fork truck line sports models with capacities of 3000, 4000, and 5000 lbs. Gas-powered, they have pneumatic tires, good visibility, many safety features, wide choice of accessories. *Hyster Co.*

CIRCLE NO. 41, PAGE 19-20

Cast Iron Data Released

A new summary of cast iron specifications has been released by the Gray Iron Founders' Society according to D. H. Workman, executive vice president. The four page leaflet covering the commonly used specifications of gray and nodular cast irons was edited by C. F. Walton, technical director GIFS.

Specifications for cast pressure pipe, soil pipe, valves and fittings are also summarized. Included in the list of principal specifying bodies are the American Standards Association, American Society of Mechanical Engineers, American Society of Testing Materials, Society of Automotive Engineers, American Water Works Association, Canadian Standards Association and federal and U. S. military services.

MORE FACTS on all products, literature, and services shown in the advertisements and listed in Products & Processes and in For the Asking can be obtained by using the handy Reader Service cards, pages 19-20.

CIRCLE NO. 170, PAGE 19-20

YOU FIGURE IT...

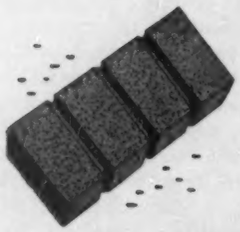
Subtract the few

Pennies it costs...

Add the Advantages of Cleaner Iron,

Reduced Sulphur, Less Cupola Maintenance...

and You'll Buy...



Famous CORNELL CUPOLA FLUX

OFTEN IMITATED • NEVER EQUALLED!

Why it pays to use Famous CORNELL Aluminum and Brass Flux

- Makes metal pure and clean.
- Permits use of more scrap without danger of dirt, porous places or spongy spots, due to dirty metal.
- Thinner, yet stronger sections can be poured.
- Metal does not cling to the dross as readily.
- Crucible or furnace linings are kept clean and preserved.
- Cleanses molten brass even when the dirtiest brass turnings are used.
- Saves considerable tin and other metals.
- Forms a perfect covering over the metal during melting, prevents oxidation and reduces obnoxious gases to a great extent.

Write for Bulletin 46-A

The **CLEVELAND FLUX** *Company*

1026-40 MAIN AVENUE, N. W. • CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

FAMOUS CORNELL FLUXES

Trade Mark Registered

BIF Elects Officers

Members of the Institute of British Foundrymen at their 53rd annual conference held during June at Cardiff, elected H. J. V. Williams as president. Other officers elected were J. Blakiston, senior vice president and A. E. Peace, junior vice president.

Additional business included presentation of medals and awards. Those receiving honors were: E. J.

H. J. V. Williams

Fox Medal to F. W. E. Spies in recognition of contributions he made in promoting cooperation among foundrymen of the world; Oliver Stubbs Medal to John Steele in recognition of services in imparting information to foundrymen in Great Britain and South Africa; Meritorious Services medal to Dr. E. R. Walter in recognition of 25 years service as secretary of the Lincolnshire section; British Foundry Medal and Prize to A. Talbot for his paper on "Cores and Moulds by the CO_2 Process." and the John Bell scholarship to Ian Earnshaw for work in applied chemistry at the Royal Technical College, Glasgow.

Diplomas were awarded to J. McGrandle for his paper on "Scrap Investigation" and to J. A. Wilkins for his paper on "Dust and Fume Extraction in Foundries."

"Fundamental Considerations for Cupola Operations" was the official exchange paper from the American Foundrymen's Society. It was presented by W. R. Jaeschke, consulting metallurgical engineer of Whiting Corp., Harvey, Ill.

President Williams is joint managing director of John Williams & Sons (Cardiff), Ltd., established in 1844 by his grandfather.—*G. Lambert, Secretary, I. B. F.*

CIRCLE NO. 171, PAGE 19-20

Does Former Winner's Entry Give You Ideas?

Cash prizes totalling $6,300 have been announced for the 3rd product development contest sponsored by the Steel Founders' Society of America. The contest, conducted every third year by the committee on product and market development, will end June 1, 1957.

National prizes of $1,000, $750, $400, $200 and $100 are being offered in each of two classes. A total

Judged as best in 1954

of $1,400 is being offered to employees of S.F.S.A. member companies in divisional awards.

Competition in the first classification is open to employees of customers of the steel casting industry, professors, college students and engineers. The second includes employees of steel casting producers in the United States, Canada and Mexico.

Certificates will be awarded on a national basis in each group. Subjects for this competition will be functional analysis, engineering a steel casting, redesign of a steel casting, conversion to a steel casting, cast-weld, composite-weld, close tolerance steel castings, improved steel castings performance, treatment of a steel casting, manufacturing operations, administrative factors, inspection and steel castings in use.

No restriction has been placed on metals or alloys if it is considered a steel casting or is practical for production in a steel foundry.

Now Where Was That?

■ You will have no trouble locating articles in back issues if you write for the index to 1955 issues of MODERN CASTINGS.

COLEMAN OVENS

turn minutes into money...

Coleman Tower® Oven

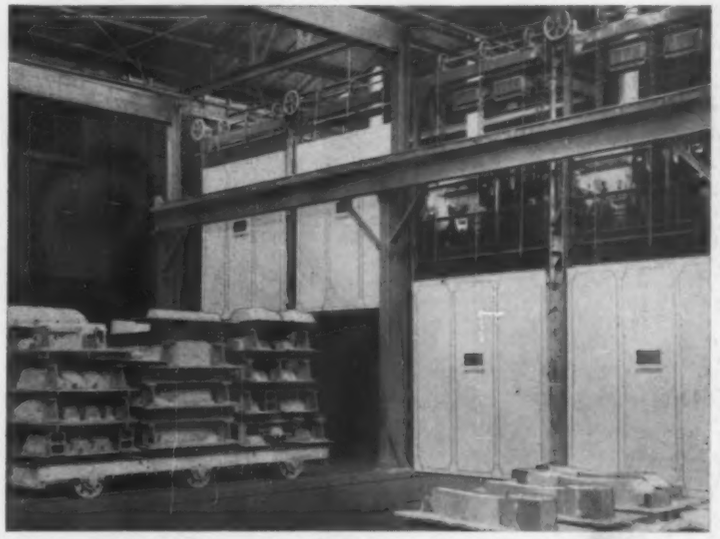
Fast, efficient production of uniformly good cores and molds is vitally important to foundry profits.

When you use old, out-dated core and mold ovens the minutes and hours lost in costly rejects and make-overs . . . the time and effort lost in wasted man power, the production lost in casting scrap eat your profits away. Modern design and exclusive advantages of Coleman Ovens result in immediate production economies, reducing overall core department costs by as much as 50%! Such savings mean increased profits and rapid investment amortization.

More than half a century of specialized foundry oven experience is your assurance that the Coleman Oven recommended to you will do your work to your complete satisfaction. ***As builders of the world's only complete line of foundry ovens we have no reason to recommend any but the best for your purpose.*** Let our experienced engineers give you practical suggestions for your particular requirements.

WRITE FOR BULLETIN 54

Coleman Transrack Ovens



Coleman Car-Type Core Ovens

Coleman Dielectric Oven

A COMPLETE RANGE OF TYPES AND SIZES . . .
for every core baking and mold drying requirement:
Tower Ovens • Horizontal Conveyor Ovens
Car-Type Core Ovens • Car-Type Mold Ovens
Transrack Ovens • Rolling Drawer Ovens
Portable Core Ovens • Portable Mold Dryers
Dielectric Core Ovens

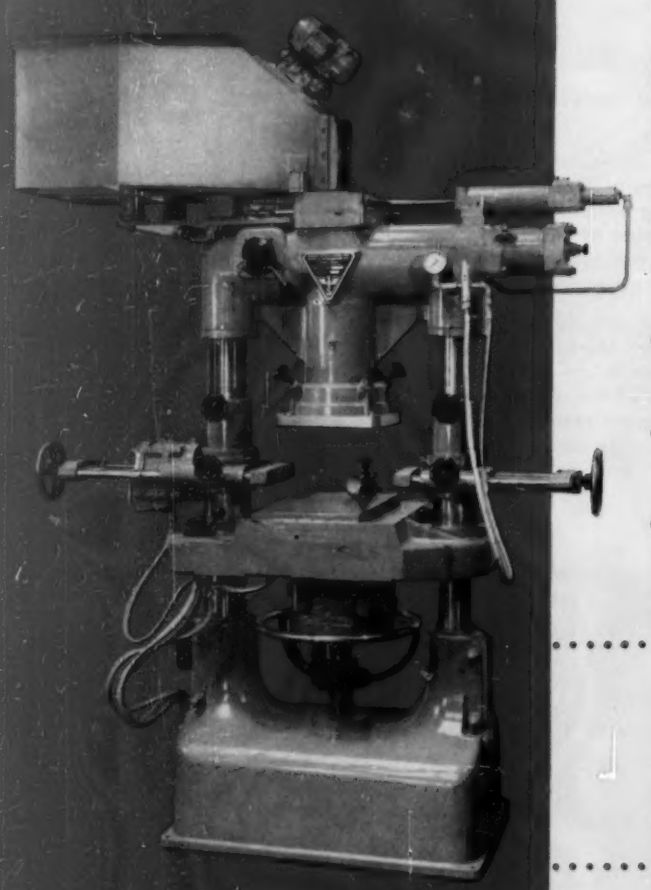
THE FOUNDRY EQUIPMENT COMPANY
1825 COLUMBUS ROAD CLEVELAND 13, OHIO

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

CIRCLE NO. 172, PAGE 19-20

V + S Core Shooter

...for fast, economical production of cores



- The V + S Core Shooter is as revolutionary as the first core blower. It offers an entirely new core making technique.
- Extremely high green strength "stand up" cores can be made with any binder —oil, resin, or STEINEX*. This amazing machine will even shoot molding sand.
- Wooden core boxes can be used as successfully as metal boxes. Very little air used.
- Economical for mass production and short runs as well. Core boxes can be changed readily.
- Extremely simple—no motors, relays, wires, no bearings, shafts or plows to contend with—assuring fewer shutdowns and less maintenance cost.

The V + S Core Shooter is available in 4 sizes of varying capacities. Sheet Heads can be furnished to accommodate all core boxes.

Try This Kleenex Tissue Test

Place half a KLEENEX tissue in the core box and shoot it in the V + S Core Shooter. The Kleenex will not be damaged. A regular core blower will tear it to bits.

Ideal for CO_2 Process with STEINEX because hardening in shoot holes and shoot heads is eliminated.

***STEINEX** is a remarkable core sand binder. Cores and shell molds, made of core sand mixed with STEINEX can be hardened in a few seconds by the injection of carbon dioxide — and used immediately

Phone or Write for Full Information and Literature

STEINEX

CARVER FOUNDRY PRODUCTS CO.

1054 HERSHEY AVENUE, AMHERST 3-1845, MUSCATINE, IOWA

CIRCLE NO. 173, PAGE 19-20

AMHS Holds Exposition

Over 160 exhibitors displayed at the National Material Handling Exposition sponsored by the American Material Handling Society. An estimated 26,500 persons visited the four day exposition held at Cleveland June 5-8 where approximately 2,000 new pieces of equipment were shown.

Technical sessions were held centering around the theme "Integrate Handling – Management Profit Tool." Included in the program were discussions of work measurement, space control, plant layout, cost analysis, automation, work simplification, distribution, traffic management, and training programs.

Officers elected are: President, Herbert S. Jones, Dominion Bridge Co., Ltd., Montreal, Quebec, Canada; First Vice-President, Frank G. LaTour, Mohawk Carpet Mills, Amsterdam, N. Y.; Second Vice-President, William E. Kappler, North American Aviation, Inc., Los Angeles; Secretary, Lynn J. Riege, United States Gypsum Company, Chicago; and Treasurer, Alfred J. Van Benschoten, Raybestos Manhattan, Inc., Passaic, New Jersey.

Featured speakers at the annual dinner were John R. Bright, chief planning engineer of John Lucas, Ltd., Birmingham, England, and J. Wellington Hall, Westinghouse Corp., of New Jersey and outgoing president.

John R. Bright of Harvard University's Graduate School of Business Administration presented a paper entitled "Management Aspects of Automation", a discussion of popular beliefs concerning automation. This lecture based on a 13 plant study indicated that there is a distinction between eliminating labor and raising productivity. Nine of the 13 plants reviewed, showed automation resulted in increased productivity rather than elimination of workers.

More information on any of the products and services advertised as listed in MODERN CASTINGS can be yours without cost or obligation. Just circle the item numbers on the Reader Service Cards provided on pages 19-20.

let's get personal

The American Foundrymen's Society has announced the election of new officers for several of its activities. **S. C. Massari,** National Engineering Co., has been elected the society's alumni secretary. **Harold W. Lownie, Jr.,** Battelle Memorial Institute, has been elected vice-chairman of the Gray Iron Division of the society's technical committee program. A full new slate of officers for the Pattern Division includes: **John F. Roth,** Cleveland Standard Pattern Works, chairman; **O. C. Bueg,** Arrow Pattern & Eng. Co., vice-chairman; and **J. M. Kreiner,** National Malleable & Steel Castings Co., secretary.

Herbert F. Scobie . . is now field director for Non-Ferrous Founders' Society, resigning as editor of MODERN CASTINGS on July 1. Formerly a consultant and foundry instructor at the University of Minnesota, he joined AFS in 1945 and had been associated with the magazine since 1948.

D. T. Wellman, president of Wellman Bronze and Aluminum Co., Cleveland, was recently reelected to presidency of the Magnesium Association. The Wellman firm also recently named **E. C. Williams, Jr.,** as manager of customer relations. He was formerly associated with Alloy Precision Castings Co.

Arthur C. Buesing . . has been appointed foundry engineer for Gray Iron Research Institute, Inc. Buesing moves from Modern Equipment Co. to this new post which will involve application of research developments to foundry practice.

Personnel changes recently announced by the Jeffrey Mfg. Co., Columbus, Ohio, include: **W. K. Myers** now district manager of firm's New York office; **Tom Fear, Jr.,** now manager for the St. Louis office; and **John Chrystall** now manager of the Columbus office. **A. T. Loew** succeeds Chrystall as manager of original equipment sales.

Walter Bonsack . . aluminum alloy metallurgy authority and former chairman of the light metals division of the American Foundrymen's Society has joined the staff of William F. Jobbins, Inc., Aurora, Ill., as special metallurgical consultant and sales engineer on the West Coast.

C. E. Heckethorn . . has been named foundry superintendent of

H. F. Scobie

A. C. Buesing

D. T. Wellman

To help you with
YOUR ABRASIVE PROBLEMS

Your choice of one or more pieces of literature which shed a light on the complicated problems of blast cleaning abrasives. No tricks, no strings, no obligation!

"A PRIMER ON THE USE OF SHOT AND GRIT"

a 20-page question and answer booklet written *without bias,* from your point of view.

"IT'S TRIPLETS"

a small leaflet that discusses the new look and advantages of palletized abrasives (at no extra cost to you).

"TIRED OF MAKING TESTS?"

This pamphlet suggests a simple control solution of blast cleaning operations. So simple an office boy can operate it—does away with "testing" and never interferes with your operations.

This literature will be sent to you with the compliments of *Controlled T Shot & Grit and Permabrasive Annealed Shot & Grit*—the abrasives that guarantee a savings* in writing and pay off in hard, cold cash money.

*10% in the case of Permabrasive, 15% in the case of Controlled T

WRITE FOR:

☐ "A Primer on the Use of Shot and Grit"
☐ "It's Triplets" (A Story of Palletizing)
☐ "Tired of Making Tests?"

THE NATIONAL METAL ABRASIVE COMPANY
Cleveland, Ohio
THE WESTERN METAL ABRASIVES COMPANY
Chicago Heights, Illinois

SOLD EXCLUSIVELY BY
HICKMAN, WILLIAMS & CO.
(INCORPORATED)

CHICAGO • DETROIT • CINCINNATI • ST. LOUIS • NEW YORK
CLEVELAND • PHILADELPHIA • PITTSBURGH • INDIANAPOLIS

There's Only ONE HELSPOT

HELSPOT PLASTIC is packed in 100-lb. waterproof cartons, already sliced for ease of handling.

HELSPOT is an exclusive MEX-R-CO product, designed for lining ladles, spouts, runners and metallurgical furnaces in grey iron, malleable iron and steel foundries and non-ferrous shops wherein the refractory comes in contact with molten metal or slag.

HELSPOT BRICK, unburned, are furnished in standard 9-inch series shapes and 9x4x4 cupola block sizes, palletized for shipment, ready for installation.

MEX-R-CO's latest contribution to the metal melting industry . . . outstanding in performance. The graphite-base brick are manufactured by a new process of pre-manufactured base materials. They are very uniform in structure and size, low in porosity, and shrinkage is negligible. HELSPOT BRICK are highly recommended for superior performance in cupola wells, runners and spouts and in ladle linings. They give 4 to 5 times greater service than ordinary firebrick and help increase metal purity.

HELSPOT DRY is available for those who prefer a dry material to be mixed on the job. Shipped in 100-lb. bags.

If you are not now using HELSPOT, we invite you to test it in your own plant. — HELSPOT products are widely used in a wide variety of applications throughout the country . . . their performance records are testimony of their worthiness in your operations.

MEX-R-CO products are stocked and distributed in principal industrial areas. See the classified section of your telephone directory for the distributor nearest you.

MEX-R-CO

106

MEXICO REFRACTORIES COMPANY
MEXICO, MISSOURI
Divisions: NILES FIRE BRICK CO., Niles, Ohio • NATIONAL REFRACTORIES CO., Philadelphia, Pa.
Canadian Affiliate: REFRACTORIES ENGINEERING & SUPPLIES, LTD., Hamilton, Ontario, Canada

CIRCLE NO. 175, PAGE 19-20

Howell Foundry Co., Inc., Los Nietos, Calif.

Ray Olson . . former vice-president in charge of sales for Shell Process Inc. and Production Patterns &

Ray Olson

Foundry Co. has joined Southern Precision Pattern Works, Inc., Birmingham, Ala., as vice-president.

Kenneth M. Smith . . has been promoted to staff engineer in the

K. M. Smith

plant engineering section of the Caterpillar Tractor Co.'s general manufacturing offices, Peoria, Ill.

F. T. McGuire

Promotions at Deere & Company, Moline, Ill., have moved **F. T. McGuire** to position as works manager of John Deere Harvester Works.

C. W. Ray succeeds McGuire as manager of Deere's Materials Engineering Dept.

G. W. Johnson

A new sales division and two new executive sales posts have been created by Vanadium Corp. of America. The steel foundry and the iron foundry divisions of the company

H. H. Wilder

have been consolidated into one division to be headed by **George W. Johnson. Howard H. Wilder,** former iron foundry division manager, is now assistant manager of engineering sales.

C. L. Pinkston

Clyde L. Pinkston . . is now field director, Foundry Educational Foundation.

Pete O'Neil . . has retired as vice-

FOR CO_2 PROCESS

DU PONT

SODIUM SILICATE

AVAILABLE IN TANK CARS, TANK TRUCKS AND DRUMS

Low in cost—consistently high in quality, Du Pont Sodium Silicate meets the exacting standards of precision foundry work.

Sodium Silicate is shipped from four Du Pont plants strategically located to serve you.

For further information, call or write our nearest office.

GRASSELLI CHEMICALS DEPT.
E. I. du Pont de Nemours & Co. (Inc.)
Wilmington 98, Delaware

SALES OFFICES AND WAREHOUSES:

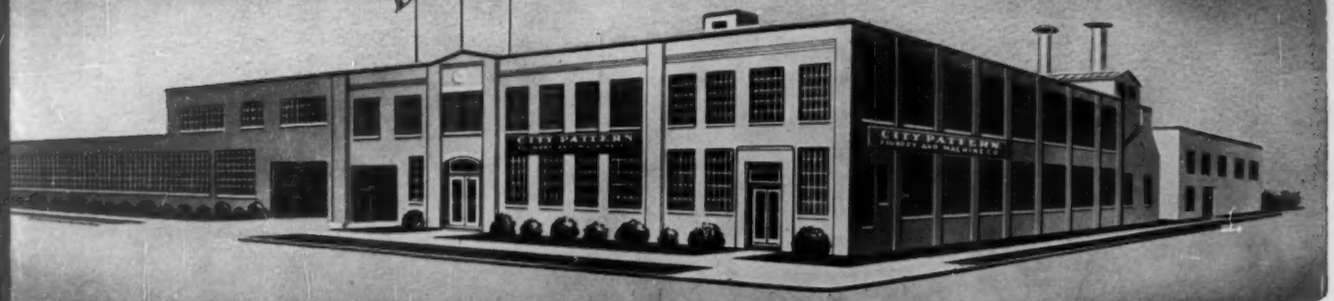
Atlanta 8, Ga. ... 739 West Peachtree Street	Houston 25, Texas ... 1100 E. Holcombe Blvd.
Birmingham 11, Ala. P.O. Box 67, Powderly Sta.	Milwaukee 13, Wisc. 6500 West State Street
Boston 10, Mass. ... 140 Federal Street	Minneapolis 2, Minn. ... 1207 Foshay Tower
Charlotte 1, N. C. ... 427 West 4th Street	New Haven 13, Conn. ... 46 River Street
Chicago 32, Ill. ... 4251 South Crawford Avenue	New York 1, N. Y. ... 350 Fifth Avenue
Cincinnati 2, Ohio ... 603 Terrace Plaza Bldg.	Philadelphia 3, Pa. ... 1617 Penna. Blvd.
Cleveland 14, Ohio 1321 Natl. City Bank Bldg.	Pittsburgh 19, Pa. ... 1715 Grant Bldg.
Detroit 35, Mich. ... 13000 West 7 Mile Road	St. Louis 7, Mo. ... 112 West Ferry Street

In Canada: Du Pont Company of Canada Limited, Box 660, Montreal, P. Q., Canada

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

CIRCLE NO. 176, PAGE 19-20

Here are Complete facilities...



for your CAST AND MACHINED PARTS

City Pattern Foundry & Machine Company offers unparalleled facilities for the complete production of cast and machined parts. Working directly from your part print, we make the pattern, cast the parts and then precision machine them; all operations are performed right under our own roof.

In every phase of the processing the most modern methods and equipment are used. And to safeguard consistent high quality, every known piece of inspection equipment is on hand to chemically, physically and dimensionally measure your parts before shipment.

Thus, complete responsibility for your cast machined parts are in the hands of one competent, completely equipped source. Why not take advantage of the obvious benefits next time you are ordering cast and machined parts.

SETTING THE PATTERN IN PATTERNS

Since 1913...

CITY PATTERN
FOUNDRY AND MACHINE CO.

PHONE TR 4-2000 1161 HARPER AVENUE, DETROIT 11, MICHIGAN

president, Dexter Foundry Div., Philco Corp., Fairfield, Iowa, and now manages Martin Foundry & Machine Co., Centerville, Iowa.

E. E. Troyer . . was elected president of Tamms Industries, Inc., at a recent meeting of the corpora-

E. E. Trover

tion's directors. He has been with the firm since 1934 and has been a vice-president since 1944.

Developments in both sales and service at Shallway Corp. have added two men to shell molding equipment manufacturer's staff. **Arthur Woods** has been named to head a European office for the firm. Temporary location of the new office will be in Duesseldorf, Germany. Back in the States, **F. G. Boucher** has been named Shalco service coordinator.

Ralph M. Enriquez . . president of Aluminum Products of Los Angeles has been appointed by the Gover-

R. M. Enriquez

nor of California as a member of the 48th State Agricultural District Board.

Carl Beers . . new Michigan representative of the International Molding Machine Company, and Carl

CIRCLE NO. 177, PAGE 19-20

Mayer Corp., manufacturers of ovens and furnaces, is located at 19021 Hillcrest, Birmingham, Mich.

Thomas W. Pangborn . . Pangborn Corp. president was awarded an honorary degree at the recent commencement exercises of Catholic University of America, Washington, D. C.

Electro Metallurgical Co. has reported four recent personnel changes: **Charles M. Offenhauer** has been named manager of administration of the Metals Research Laboratories; **Daniel L. Weller** has become a technical sales and service representative in the Pittsburgh district; **Robert M. Fowler** and **Hendrik de Wet Erasmus** have been appointed research consultants at the Metals Research lab.

Robert R. Stough . . is now sales engineer for Precision Metalsmiths, Inc., Cleveland.

Frank J. Vuranch . . has been named chief service engineer by the Foundry Equipment Co., Cleveland, manufacturer of Coleman ovens. He has been a service engineer for the company since 1951.

Reed D. Holt . . has joined Blaw-Knox Co., National Alloy Div., as a sales representative.

Duncan Gardiner . . recently named director of research and development for Vickers Incorporated, Detroit.

Robert C. Johnston . . has been made resident manager of the Chicago office of Hickman, Williams & Co. He succeeds John H. Abbott who recently retired.

John S. Tiedemann . . has moved from Minneapolis-Moline Co. to become assistant superintendent of Minneapolis Electric Steel Castings Co.

A. James Fisher . . has been appointed general sales manager of Metal & Thermit Corp.

Recent appointments by the Norton Co., Worcester, Mass., include naming **K. F. Ebbeson** an abrasive engineer in the Boston area, and

YES! . . . I want to receive MODERN CASTINGS regularly.
Enter my subscription for one year at $3 (U.S., Canada, Mexico); $6 elsewhere.

☐ Payment is enclosed ☐ Bill me later

Name..... Position or Title..... (Important)

Address ☐ Home ☐ Business .....

City ..... Zone..... State.....

Company .....

Subscribe to MODERN CASTINGS

Help yourself to these cards and do yourself a favor. If you don't belong to the American Foundrymen's Society, send in the top card and start to read the most popular magazine in the industry regularly. If you want more information on the products advertised or listed in this issue, send us one of the postage-free reader service cards below and we'll do all the rest.

Send for FREE DATA

Please type or print 56/8

Please have information or bulletins indicated by circled numbers sent to me without obligation.

Name _____ Title _____

Company _____

Address _____

City _____ Zone ____ State _____

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240

Please use card before February 1, 1957

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD
First Class Permit No. 83, Sec. 34.9 P. L. & R. DES PLAINES, ILL.

Reader Service Dept.
MODERN CASTINGS
Golf & Wolf Roads
Des Plaines, Illinois

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD
First Class Permit No. 83, Sec. 34.9 P. L. & R. DES PLAINES, ILL.

MODERN CASTINGS
Golf & Wolf Roads
Des Plaines, Illinois

Subscribe to MODERN CASTINGS

Help yourself to these cards and do yourself a favor. If you don't belong to the American Foundrymen's Society, send in the top card and start to read the most popular magazine in the industry regularly. If you want more information on the products advertised or listed in this issue, send us one of the postage-free reader service cards below and we'll do all the rest.

Send for FREE DATA

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD
First Class Permit No. 83, Sec. 34.9 P. L. & R. DES PLAINES, ILL.

Reader Service Dept.
MODERN CASTINGS
Golf & Wolf Roads
Des Plaines, Illinois

Please type or print 56/8
Please have information or bulletins indicated by circled numbers sent to me without obligation.
Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240

Please use card before February 1, 1957

appointment of **H. L. Gibbs** as a field engineer at the St. Louis office.

Lawrence L. Garber . . is now vice-president in charge of production for H. K. Porter Co., Inc.

Charles W. Davis . . has joined sales staff of Bohn Aluminum & Brass Corp.

Robert M. Gatti . . has been named branch manager of the Richardson Scale Co.'s Cincinnati office.

George Sines . . has been named chief engineer of the Easton Car & Construction Co.'s industrial car division.

AFS Radiation Group Outlines New Manual

A proposed outline of the Radiation Protection Committee's manual was adopted at its meeting April 10, 1956. This group is associated with the American Foundrymen's Society. Preface of the manual will be written by Herbert J. Weber of the AFS staff and chairman pro tem of the committee.

Its introduction will include sections on hazards, selection and training of personnel, instrumentation, personnel monitoring and medical controls and shielding in general. Under procedures will be discussed isotope handling in the laboratory, general procedures in radiography, use of isotopes as tracers in melts and emergency procedures.

Evans Heads Alloy Casters

Bradley B. Evans, Empire Steel Castings, Inc., Reading, Pa., was elected president of the Alloy Casting Institute at its 16th annual meeting held during June at Hot Springs, Va. Evans, formerly vice-president, succeeds Thomas Rutherford, Midvale Co., Philadelphia.

Other officers are F. M. Fahrenwald, Fahralloy Co., Harvey, Ill., vice-president, and E. A. Schoefer, Mineola, N. Y., vice-president and treasurer. Named as directors were P. L. McCulloch, Jr., Electro Alloys Div., American Brake Shoe Co., Elyria, Ohio, and R. A. Hipke, Sivyer Steel Casting Co., Milwaukee.

Malleable Founders Report From The Homestead

Malleable Founders' Society held its 21st annual meeting at The Homestead, Hot Springs, Va., on June 10-12. Features of the meeting included a review of society activities by President Carl L. Liebau, Federal Malleable Co., West Allis, Wis., reports by staff executives, the showing of a new foundry film, "To Meet the Challenge," developed by James H. Smith, Central Foundry Division, General Motors Corp., Saginaw, Mich., and an address by Dr. Ralph E. Lapp, atomic energy consultant, entitled "The World of Tomorrow."

Special safety awards, for the best 5-year frequency rates for the period 1951-55, were presented to:

Group I (less than 100 employees)
Richmond Malleable Castings Co., Richmond, Ind.

Group II (100 to 200 employees)
Erie Foundries Division, General Electric Co., Erie, Pa.

Group III (200 to 400 employees)
Texas Foundries, Inc., Lufkin, Texas

Group IV (over 400 employees)
Central Foundry Div., General Motors Corp., Saginaw, Mich.

The highlight of the Society's annual banquet on June 11 was the presentation of the Charles H. McCrea Award "for distinguished service to the malleable castings industry." The recipient of the award for 1956 was Charles S. Anderson, Belle City Malleable Iron Company, Racine, Wis.

In presenting the award, Mr. Gutenkunst cited Anderson's outstanding service over a long period of years in promoting the welfare of the industry. He referred particularly to his unselfish attitude toward "all things for the good of the industry." Anderson was active during World War II and during the Korean emergency on industry advisory committees in Washington.

New officers named at the elections held during the meeting are: Leon J. Wise, Chicago Malleable Castings Co., Chicago, *president;* P. C. DeBruyne, Moline Malleable Iron Co., St. Charles, Ill., *vice-president;* D. V. Walker, Eberhard Mfg. Co. Div., Eastern Malleable Iron Co., Cleveland, *treasurer.* Lowell D. Ryan was reelected as the society's secretary.

NEW
CUPOLINOR
1500
HIT OF THE FOUNDRY SHOW
THE NEW GUN FOR REFRACTORIES – Eastern Clay proudly presents the finest refractory gun in history, created to give the foundryman the sweetest, smoothest, easiest operating gun he ever handled. The new Cupolinor 1500, built on the success of hundreds of installations of the original and widely popular Bondactor, is completely re-designed with many new features that will give you a new experience in automatic operation, simplified handling and control and high-speed, long-life, low-cost performance.
Write today for folder "Patching with Cupolinor"
EASTERN CLAY PRODUCTS DEPT.
INTERNATIONAL MINERALS & CHEMICAL CORPORATION
General Offices: 20 North Wacker Drive, Chicago 6
CIRCLE NO. 178, PAGE 19-20

Three Steps to Better Castings and Increased Profits

1. specify

Settling certain points with your customer at the outset insures your profit and his satisfaction upon delivery of the completed order. First determine the service requirements of the casting and characteristics desired. Establish a standard which satisfies the needs at a reasonable cost. Find out if the design is satisfactory functionally, structurally and *foundry-wise.*

2. design

Good design insures trouble-free foundry practice, profitable operation and customer satisfaction. Castings with even stress flow are more serviceable and easier to pour. Experimental stress analysis with M Stresscoat brittle lacquer enables your engineers to make design changes without guesswork or wasted effort. Design for service, easy casting, and high profits.

3. inspect

M Magnaglo (M Zyglo for non-ferrous) is recommended as a "finger on the pulse" means of determining the causes of cracking in the foundry. Simple tests immediately after shakeout or cleaning can locate cracking when it first occurs and enable you to take corrective steps no matter what the cause. With sampling inspection you can actually control the quality of the entire run as it is being poured. You do not waste time and profits handling, heat treating, finishing, etc., intermittent lots of cracked castings. It all adds up to better products for the customers and higher profits for the foundry!

Write for details on how Magnaflux nondestructive testing methods can be employed to increase the yield of usable castings and foundry profits. No obligation, of course!

HALLMARK OF QUALITY IN NONDESTRUCTIVE TESTING

MAGNAFLUX CORPORATION

7352 W. Lawrence Avenue • Chicago 31, Illinois

New York 36 • Pittsburgh 36 • Cleveland 15
Detroit 11 • Dallas 19 • Los Angeles 58

CIRCLE NO. 179, PAGE 19-20

How New Jersey Looks At Air Pollution Problem

HERBERT J. WEBER

■ At the Air Pollution Control Association annual meeting held in Buffalo, N. Y., May 20-24, 1956, William R. Bradley, chairman of the State of New Jersey Air Pollution Control Commission outlined the state's air pollution control program. Bradley is also in charge of industrial hygiene for the American Cyanamid Co. and a past president of the American Industrial Hygiene Association.

The creation of the Air Pollution Control Commission for New Jersey was not through hastily enacted legislation but is the result of four years of intensive study. The following organizations made valuable contributions to the philosophy of the act: Manufacturing Chemists Assoc., American Society of Mechanical Engineers, American Industrial Hygiene Assoc., National Assoc. of Power Engineers, Departments of Engineering, Agriculture and Law of the state university, State Departments of Health, Labor and Industry, and Agriculture, and representatives of industry and the public.

Here are some of the reasons why the New Jersey problem will be solved on a rational basis:

1. Members of the commission receive no salary.

2. No code, rule, or regulation, amendment or repeal may be adopted without a public hearing held only after 30 days' notice by public advertisement.

3. When investigation discloses violation of any code, rule or regulation, the Department of Health is required first to endeavor to bring about correction by conference, conciliation, and persuasion. In case of failure to remedy the violation in this manner, the law provides for penalties.

4. The commission is directing its initial efforts toward those phases of pollution that afford the opportunity for most immediate resolution—open burning dumps.

5. In a democratic manner, the commission holds public conferences preliminary to the public hearing and promulgation of codes, rules and regulations.

6. All codes, rules or regulations

of strictly local application, before adoption by the commission, must be submitted to county associations.

7. The public is responsible for its own contribution to air pollution. The code places upon the public the obligation to eliminate the bonfire method of disposal.

8. The commission believes that nearly everyone in New Jersey contributes to air pollution. It is one problem of many facets that requires a total program.

9. Costs must be shared so that the benefits of clean air may be mutually enjoyed. All must join in resolving this problem which affects everyone, through a program administered by one agent.

10. The commission is firm in its stand that politics may not be permitted to interfere with air pollution abatement efforts.

Dr. Thomas A. Cowan, commenting on the New Jersey Air Pollution Control Act in Volume IX, Number 4 (Summer 1955) of the **Rutgers Law Review** stated the following:

"The Air Pollution Control Act (1954) puts the State of New Jersey into the lead in the attack on air pollution on both the educational and the regulatory fronts. The statute provides for notice and hearing for interested parties whenever the new commission legislates or the Department of Health enforces the law, and its penalties are adequate for most violations. Those which do not yield may be reached by the more rigorous penalties of indictment or regulation under other existing laws. The legislature has gone to great lengths to make administration of our new air pollution law fair and equitable. There is no reason why much good should not come from its firm administration. To the extent that a statute can lay the groundwork and provide the means for a vigorous cleanup of the atmosphere in this state, a start has been made. What remains, of course, is the intelligent, vigorous and fair-minded administration of the exemplary piece of legislation."

Answer questions by sending for data describing the newest products and processes. Order by using the cards on **page 19-20.**

DIMENSIONAL ACCURACY...

obtained by Cooper Alloy

through SHELL MOLDING with G-E Shell Molding Resins

This stainless steel instrument housing, cast for a customer by Cooper Alloy Corporation, Hillside, N. J., was one of those "impossible" jobs. Previous experience by the customer had resulted in shrink defects in the lugs on the open face, rendering the castings unacceptable. The job was further complicated by the fact that dimensions and finish were equally critical on both exterior and interior surfaces.

Through shell molding and advanced foundry techniques, Cooper Alloy was able to convert this "impossible" job to a standard production run! Hollow shell cores achieved the required accuracy and finish for the casting's interior; the Shellcast* process accomplished similar results for the exterior. G-E shell molding resins helped Cooper Alloy obtain close dimensional accuracy, fine finish and uniform soundness.

How can shell molding help YOU?

Cooper Alloy uses *General Electric shell molding resins* in its Shellcast process, relying on them for batch-to-batch uniformity and correctly balanced properties. Other G-E products for shell molding include: *G-E silicone release agents* to release molds easily from patterns and *G-E phenolic bonding resin* to assemble shell halves together.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Ask G.E. about shell molding!

General Electric maintains a shell molding laboratory in Pittsfield, Mass., to help users and prospective users of shell molding solve problems and evaluate the process. G.E. also offers a 28-page manual describing the techniques and benefits of this new foundry method. *Just mail the coupon for a free copy!*

*Reg. trademark, Cooper Alloy Corporation

FREE SHELL MOLDING MANUAL!

General Electric Company
Section 6F481
Chemical and Metallurgical Division
Pittsfield, Massachusetts

Please send me a free copy of *G-E Shell Molding Manual.*
( ) We are presently using the shell molding process.
( ) We are interested in the shell molding process.

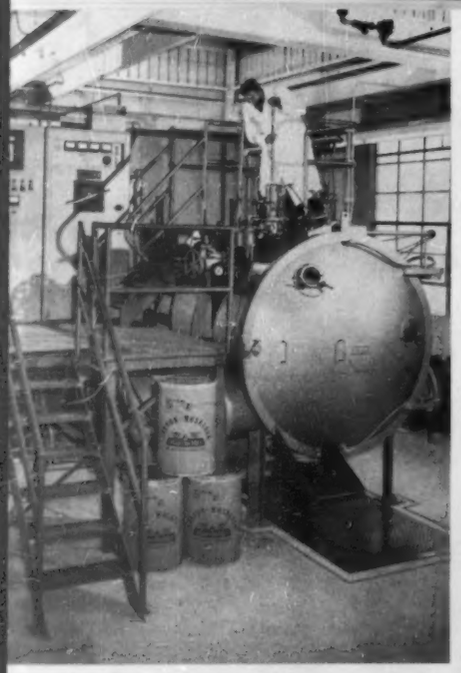
Name_____

Firm_____

Street_____

City_____ Zone____ State____

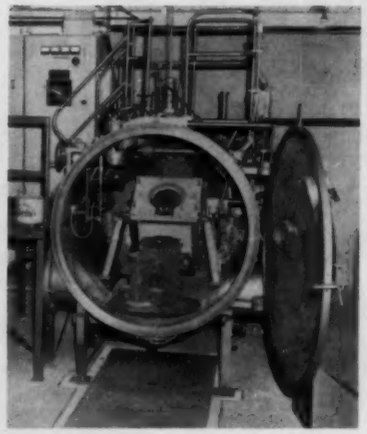
CIRCLE NO. 180, PAGE 19-20



WHAT ABOUT INVESTMENT CAST VACUUM ALLOYS?

Vacuum melting is moving from research lab to production to open fields for investment castings

F. KENNETH IVERSON
Chief Metallurgist
Cannon-Muskegon Corp.
Muskegon, Mich.



Figs. 1 and 2 . . This vacuum unit is a pioneer among furnaces built outside captive melting operations.

Most foundrymen believe this is a very impractical subject. Why should they be interested in vacuum melting? What has been done and what is being done on the investment casting of vacuum alloys? What equipment does vacuum melting require? How much will it cost and what will the castings sell for?

Because vacuum melted high temperature alloys have definitely proven their superiority, the major consumers of high temperature investment castings are replacing present cast materials with vacuum melted wrought alloys.

Based on preliminary tests and the fact that high temperature cast alloys generally outperform the wrought version of the same alloy, there is good reason to believe that investment cast vacuum alloys can give equal or better properties than vacuum wrought materials. At the present time the investment casting industry is not prepared to take advantage of this opportunity or coming applications of vacuum melting in other fields.

The investment process is the only major casting method which can be used without basic revisions for producing vacuum castings of iron, nickel and cobalt base alloys. Several years ago Cannon-Muskegon Corporation became convinced of the promising future of vacuum alloys in the investment casting field. We designed a vacuum furnace for development work in investment casting and for production of remelt alloys. This furnace is shown in Figs. 1 and 2. Basically it consists of a tank, 6 ft in diameter, 7 ft long, which contains an induction furnace of 400 lb capacity. The system is powered by a 100 KW, 3000 cycle, motor generator set.

The vacuum system is designed for pouring nickel, cobalt and iron base alloys at pressures less than 10 microns. This furnace has the accessory equipment necessary for refining and manipulation of the charge, including bridge-breaking equipment, additions mechanism, vacuum lock additions chamber, and provisions for taking temperature readings by immersion thermocouple.

There is a 3 ft diameter mold table in front of the furnace which is rotated through a vacuum seal. Molds can be placed on this table and rotated under the furnace in sequence for pouring. This turntable is designed with a seal for rotation for centrifugal casting at speeds up to 800 rpm. The tank also contains provisions for preheating and cooling molds under vacuum.

The production of high temperature alloys in this furnace parallels the procedure used by other vacuum melters with one important exception: Using air melting equipment, a base alloy suitable for the particular alloy to be vacuum melted is prepared with special deoxidizing procedures. This base alloy is charged into the vacuum furnace. After melting the heat is deoxidized with carbon. For high temperature alloys, boron, aluminum and titanium are added as required. This procedure of producing air melted base alloy has some definite advantages:

1. The air melted base alloy can be made with a shape factor which best suits the power requirements of the vacuum furnace and has the most desirable packing factor.

2. In making up the base alloy, raw materials of the highest purity can be used with little regard for their gas content. For example, electrolytic chromium has excellent purity but has oxygen contents running as high as 0.5 per cent. If charged directly into the vacuum furnace it causes considerable difficulty. However, most of this oxygen can be removed in the preparation of the base alloy.

3. A material of exactly known

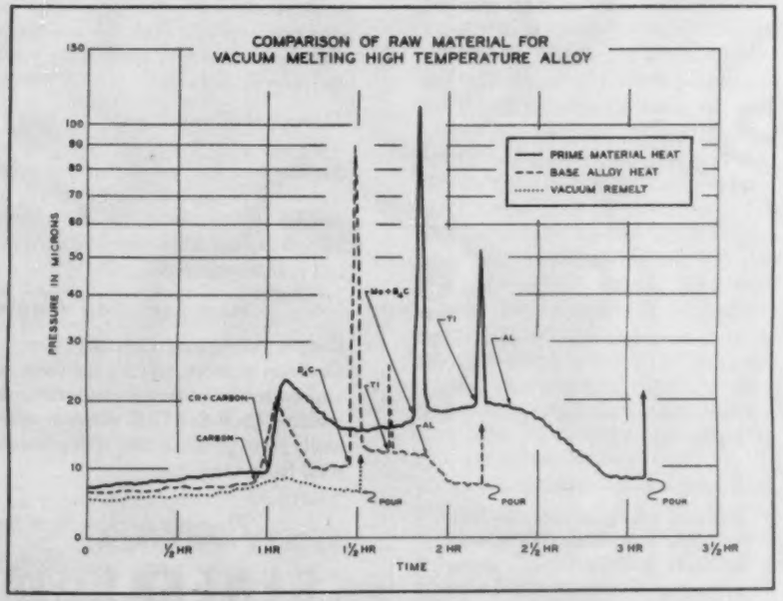


Fig. 3 . . Remelting vacuum melted alloys saves time for foundry.

gas content is charged into the vacuum furnace. The gas content of different lots of raw materials can vary considerably; however, in preparing base alloys, if good procedures are used, the gas content of the final material will be at approximately the same level each time regardless of most variations in the gas content of the raw materials used. This provides the vacuum melter with the advantage of starting each heat with an exact known quantity of gas in the charge.

4. The total gas content of the charge is reduced appreciably by using an air melted base alloy. Actually, with high temperature alloys the base alloy contains less than 1/5 the amount of oxygen which would be present in the chromium alone if electrolytic chromium is used.

The results of these advantages are obvious. The use of air melted base alloys for vacuum heats reduces the melting time and produces a more consistent product.

Fig. 3 is a comparison of melting time and pressures for vacuum heats of prime materials, base alloys and vacuum remelt. This illustrates that the use of an air melted base alloy reduces the total heat time by 25 per cent and also allows the heat to be made at lower pressure levels. This chart also shows the savings of time for a vacuum remelt. The length of time for a vacuum remelt heat is less than half the time required to produce from prime materials.

■ We have poured a number of different mold materials in our vacuum furnace, including investment molds, core sand molds, permanent molds, shell molds and others. At the present time, the investment mold appears to be the most satisfactory method of producing castings of iron, nickel and cobalt base alloys. This does not mean it is without problems. The most serious problem that we have encountered is the outgassing of the mold during pouring. Even though this action can be quite violent, in most cases it does not appear to be due to any reaction between the metal and the investment material. We have found several steps which help to reduce this difficulty:

1. Preheating the mold to a fairly high temperature (1800-1900 F) under vacuum reduces the action. This is accomplished by putting the mold at 1800 F into a preheating chamber, inside the vacuum chamber, before pumping down for a heat. While the charge is being melted, the mold temperature reduces to the temperature of the vacuum preheating chamber.

2. A second method which has had some advantage is to place a pouring cup on the investment mold and raise the riser 2 or 3 in. Even if the action is violent, sufficient metal is retained in the riser to produce a sound casting.

3. There is some indication that substantial improvement is obtained by venting the investment mold so that the gas has an opportunity to escape by other routes than the casting cavity itself. Further work is needed on the exact type and location of these vents.

The work which has been done this far on vacuum investment castings has indicated that little change is necessary in gating or risering techniques. Gating methods which produce satisfactory results under static air pouring will produce good castings when poured in vacuum if proper mold materials are used. It is also true that poorly gated molds will not be improved by vacuum casting.

Not all dip coats are satisfactory for investment molds that are to be vacuum poured. Some dip coats, sodium silicate in particular, give a violent reaction when heated rapidly under vacuum.

There are two basic processes which can be used for the production of investment castings from vacuum alloys:

1. Remelting vacuum alloys under an inert gas, generally argon.

2. Melting and pouring investment castings under vacuum.

■ **Argon remelting.** Argon remelting consists of having the metal completely surrounded with argon at all times during melting and pouring. The metal never comes in contact with air. This is not as difficult to accomplish as you might suppose. The furnace must be fairly well enclosed but far from air tight. The argon is fed continuously and a slight pressure of argon is maintained in the chamber.

When the metal has reached the pouring temperature the mold is clamped on an opening and purged a few minutes before pouring. This system has these advantages:

1. As far as equipment costs, it is certainly the most economical method of producing castings from vacuum alloys. An existing furnace can be modified for argon melting for $400 to $500. The complete equipment, including furnace and power supply, does not run more than several thousand dollars.

2. Without difficulty, production rates approaching those for air melting can be obtained.

3. With the high temperature alloys containing aluminum and titanium, argon remelting provides properties which compare favorably with vacuum melted properties. For these alloys, the stress rupture life of argon remelted material is in the range of 80 per cent of the life of the vacuum alloy itself.

There are disadvantages:

1. There is a continuous loss of argon which results in a high melting cost. The exact cost is, of course, dependent upon the size of the chamber, its air tightness, and the rate of argon flow.

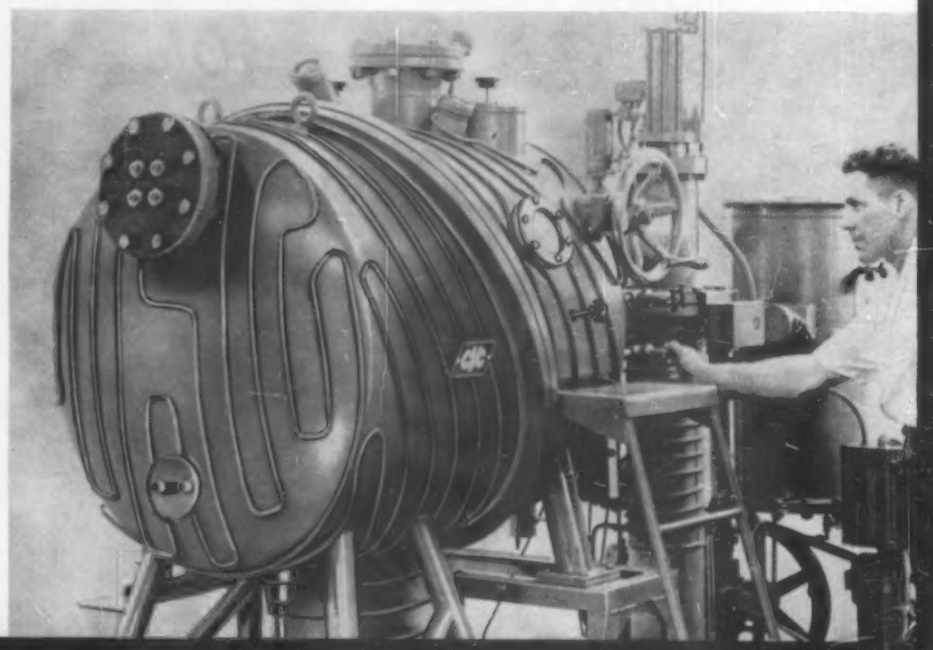
2. Present results indicate that there are many alloys where production argon remelting results in a substantial, if not complete, loss of vacuum melted properties. With some high temperature alloys which do not contain aluminum and titanium, argon remelting has shown little improvement over the properties of good air melted material.

3. It is difficult to control the quality of the argon melt. How does the operator know when the argon blanket is poor? He doesn't. In vacuum melting there are gauges to determine the level of pressure and, providing they are accurate, the operator knows the condition of his melt. With argon remelting, the only evaluation of the condition of the melt is the performance of the casting. The only method of control which seems feasible would be to have a mass spectrometer reading gas conditions inside the furnace. Even if several furnaces are monitored by the same mass spectrometer the increase in cost will be substantial.

■ **Vacuum investment casting.** Investment castings can be produced under vacuum by starting with an air-melted base alloy or prime raw materials; melting, bridge-breaking, deoxidizing, making the necessary alloy additions, and then pouring the investment mold. For production use this requires a high capital investment in an elaborate furnace having bridge-breaking equipment, mold heating facilities, additions mechanisms, and the other gadgetry associated with the melting and refining of a vacuum alloy.

Investment castings can also be produced economically and efficiently by remelting vacuum alloys. No additions are necessary. The alloy is merely remelted under vac-

Fig. 4 . . Small vacuum furnace can melt 50 lb in 30 to 40 minutes.



uum conditions and poured into the investment mold.

Both vacuum systems have the obvious advantage over argon remelting in that they can be used with all vacuum melted alloys and full advantage of vacuum melted properties is obtained. The vacuum remelting process has several additional advantages:

1. As shown in Fig. 3, a vacuum heat made from prime materials takes twice the melting time required for vacuum remelting. This, of course, means that with the remelting process the vacuum equipment operates at twice the efficiency and produces twice as many castings.

2. It is possible to design a furnace specifically for investment casting by vacuum remelting. Such a furnace would have a cost far below the price of the complete vacuum processing unit.

Fig. 4 shows a 50-lb vacuum melting furnace for investment casting. This furnace is designed for development and semi-production. The chamber pressure can be reduced to less than 10 microns in three to four minutes. Powered by a 30 KW generator, 50 pounds can be melted in 30 to 40 minutes. The furnace is fully equipped for basic vacuum processing. There is an additions mechanism, immersion thermocouple and sampling arrangements, and provisions for preheating and cooling molds. The vacuum chamber can accommodate two or three investment molds. In production, the furnace can produce six to nine molds per hour, depending on the raw materials used. This furnace sells for approximately $15,000, exclusive of power supply.

For the past year we have been talking with vacuum equipment suppliers in an effort to obtain for the investment caster a furnace specifically suited for the vacuum remelting process. A new furnace designed around these principles would operate as follows:

1. The charging chamber and the furnace are loaded with separate slugs of vacuum melted material. A hot investment mold is placed inside the chamber and the door is closed.

2. The vacuum is turned on and the pressure in the chamber is rapidly reduced to less than 10 microns.

3. The furnace charge is melted in approximately three minutes. The melting cycle is controlled either by time and power or by optical temperature readings through a 1 in. sight glass.

4. As soon as the melt is poured, the cold billet slug of vacuum melted material in the charging chamber is placed in the furnace.

5. After waiting approximately one or two minutes for the investment mold to solidify and the furnace to be cooled to a nonoxidizing temperature by the cold slug, the door is opened, the mold removed, and the cycle is complete.

The following features make this furnace outstanding:

1. This is a rapid pumping, high powered furnace using vacuum melted alloys, capable of pouring 10 x 10 in. molds at a rate of eight to ten molds per hour.

2. The 8-lb furnace and the charging chamber accommodate slugs 2½ in. in diameter by 6 in. long; or 2 in. in diameter by 8 in. long. Billet slugs of this size are presently obtainable from vacuum melters.

3. The investment casters' present generating equipment may be applicable to this furnace.

4. The cost of this furnace, except for power supply, is in the range of $5,000 to $8,000.

Certainly after all this the most important question is: What is the final casting to sell for and what is the future?

Fig. 5 is a cost comparison between air, argon and vacuum investment casting. In order to be conservative we have based the vacuum portion on equipment currently available and not on the low cost remelt furnace previously discussed.

Costs vary greatly in the investment casting industry. The figures here are not necessarily representative of the industry as a whole. They do, however, represent the costs of some specific investment casters. Individual investment casters with different costs can use this basis to figure what their increase in price would be with the vacuum or argon melting process.

The vacuum melting cost may seem high but remember it is a conservative estimate and includes the depreciation of the $60,000 investment over a two-year period on a one-shift basis.

The cost comparison is made on the basis of a constant rejection rate regardless of the method of melting. If the majority of the investment casters' rejections are due to imperfections in the pattern or mold they will not be reduced by vacuum melting. For those cases where a high percentage of the rejections are due to the metal itself there may be a significant improvement. In some cases the savings due to reduced rejection rates may permit the vacuum casting to sell for the same price as the air casting.

The outstanding fact from this cost comparison is that vacuum investment castings will not necessarily sell for three or four times, or even twice the cost of the air melted castings.

There are real possibilities for the future:

1. The low cost vacuum remelting furnace will certainly reduce the melting cost.

2. The vacuum alloy processor will develop more efficient and economical methods of production with a corresponding decrease in basic alloy price.

3. Programs have already been initiated to determine the value of gates, risers and sprues from vacuum investment castings. There is every reason to believe that the price for vacuum metal returns will be substantially above the air metal returns price.

The day is rapidly coming when the vacuum investment casting will sell for less than one-third more than the air melted casting.

SUMMARY

1. In the future, vacuum metals will have many applications where the factors limiting the design or operation of equipment are metallurgical. Investment casters are losing present and future business to vacuum melted wrought materials.

2. Investment cast vacuum alloys can do as well, or better than, vacuum melted wrought materials.

3. We, and others, are prepared to help the investment caster with his development problems and to furnish vacuum melted alloys for reprocessing.

4. The investment caster will be able to produce vacuum investment castings at less than twice the cost of comparable air melted castings and at equivalent production rates.

5. New equipment is on the way which will have a relatively low cost and can rapidly convert vacuum alloys to vacuum investment castings.

COST COMPARISON BETWEEN AIR, ARGON AND VACUUM INVESTMENT CASTING

CONDITIONS:

1. 1/2 LB CASTING.
2. 8 CASTINGS PER MOLD.
3. 50% YIELD HOT INCLUDING REJECTS.
4. 30% REJECTS FOR HIGH ALLOY CASTINGS AND 15% REJECTS FOR LOW ALLOY CASTINGS.
5. 30% MARGIN FOR HIGH ALLOY MATERIAL AND 20% MARGIN FOR LOW ALLOY MATERIALS.
6. VACUUM METAL COST - $3.00 PER LB OVER COMPARABLE AIR MELTED ALLOY.
7. FIGURES INCLUDE DEPRECIATION AND OVERHEAD.
8. VACUUM INVESTMENT FURNACE - INITIAL COST $60,000 - CAPABLE OF POURING 10 FLASKS PER HOUR.

ITEM	HIGH ALLOY MATERIAL			LOW ALLOY MATERIAL		
	AIR	ARGON	VACUUM REMELT	AIR	ARGON	VACUUM REMELT
MOLD COST	$35.00	$35.00	$35.00	$28.00	$28.00	$28.00
METAL COST PER MOLD	16.00	40.00	40.00	3.20	27.20	27.20
MELTING COST PER MOLD	2.80	5.20	9.70	2.80	5.20	9.70
CLEANING CUTOFF & INSPECTION	18.00	18.00	18.00	8.00	8.00	8.00
TOTAL COST	71.80	98.20	102.70	41.80	68.40	72.90
MINUS METAL RETURNS	6.24	6.24	6.24	.55	.55	.55
	65.56	91.96	96.46	41.25	67.85	72.35
MARGIN	19.61	27.59	28.94	8.25	13.57	14.47
	84.97	119.55	125.40	49.50	81.42	86.82
SELLING PRICE OF CASTING	$15.17	21.35	22.39	$ 7.26	11.97	12.77
INCREASE IN PRICE OVER AIR MELTING		40.3%	47.7%		64.4%	75.3%

Fig. 5 . . Costs equalize when remelted metal gives better castings.

At 1957 AFS Castings Congress...

Foundries To Show Merits of Castings

■ The first nationwide exhibit of engineered castings will be held in conjunction with the 1957 AFS Castings Congress May 6 through May 10 in Cincinnati, it has been announced by AFS President Frank W. Shipley of Caterpillar Tractor Co. It is expected to attract casting designers and purchasers from all over the U. S. and Canada.

Hitherto AFS exhibits have been held biennially as a service to equipment manufacturers and materials suppliers who sell their products to foundrymen. In 1957, however, the exhibit is designed for the first time for foundrymen to sell their products to all industry.

W. N. Davis, exhibits manager, will invite purchasing agents, designers and engineers from all industry to see the foundry products to be shown at Cincinnati. The unique exhibit will stress the engineering and economic advantages of engineered castings—their high quality and special properties, and the process controls and final inspection techniques used to produce them.

Under the theme of "Quality, Utility and Economy," the show is expected not only to attract immediate sales to exhibiting foundries but to provide a long-needed educational service for castings buyers.

Location of the exhibit is the Cincinnati Music Hall, where 70,000 sq ft has been reserved for booths whose size will be limited. In addition to foundries and pattern shops, suppliers of metals, and manufacturers of laboratory, inspection and quality control equipment will also be eligible to exhibit, AFS General Manager Wm. W. Maloney has indicated.

Concurrent with the exhibit in addition to the usual technical sessions, shop courses, and round table luncheons for foundrymen, there will be a series of papers especially prepared to augment the exhibit and to provide designers and manufacturers with latest information on design, properties, and utilization of castings.

In line with this, the subject of next year's Charles Edgar Hoyt Memorial Lecture, to be delivered by H. Bornstein, retired director of laboratories of Deere & Co. and a past president of AFS, will be *"Improvements in Castings."*

Many of the papers presented are expected to deal with process and quality control and product development. Some papers have already been scheduled and prospective authors are urged to submit manuscripts as soon as possible in triplicate to the AFS technical director, Hans J. Heine, so they can be passed on to the appropriate committee for consideration. Intention to submit a paper later can be indicated by means of an Offer of Technical Paper form available through the AFS Technical Director at the Central Office, Des Plaines, Ill.

Along with the development of the program for next year's Castings Congress, AFS technical committee and divisions are overhauling their membership. Openings exist on a number of the more than 100 committees covering every phase of foundry technology. Interested foundrymen may send a statement of their experience and interest to the AFS technical director. He will in turn pass it on to the appropriate committee or committees for consideration.

Illuminated cast bronzes dramatize Cincinnati, site of AFS Congress.

In going to Cincinnati for its 1957 annual meeting, AFS returns to the site of three previous conventions—1898, 1909, and 1939. New hotel facilities insure an adequate number of hotel rooms to accommodate the increased attendance expected by reason of the Engineered Castings Show.

Headquarters of the Cincinnati District Chapter of AFS and long known for its foundries, Cincinnati will provide 1957 Castings Congress visitors with the opportunity to view a wide variety of casting production practices. A number of foundries in the area are expected to be open for inspection during Castings Congress Week to enable foundrymen to catch up on the technology of the district. Plant visits will also enable designers, castings buyers, and engineers to round out the technical sessions and the exhibits of castings by seeing actual applications of up-to-date foundry practice.

Following a practice of long standing, there will be a ladies program to entertain wives and daughters of foundrymen tied up in Congress technical sessions and at the Engineered Castings Show.

MORE on METAL FLOW in MOLDS

Studying the flow of molten metal in the runner and gates of a sand mold

GORO OHIRA / *Associate Professor*
Tohoku University, Sendai, Japan

This is the second of two articles in which Dr. Ohira has described the investigations that he has made in the hopes of establishing general principles for gating. The study of the phenomenon of metal flow, through the use of such experimental techniques, may eventually make possible the elimination of cut-and-try gating systems. In the first article, Dr. Ohira told how mold filling time is affected by sprue shape, aspiration, gate size and location. This article, Progress in Taming the Sprue, appeared in MODERN CASTINGS, *March, 1956 pp 54 - 56.*

Gating is considered to be one of the most important factors in foundry practice. Despite the many investigations into the relationship between sprue, runners, and gates, not enough is yet known about it. This series of tests concerns the flow of metal in the runner and gates of test molds (Fig. 1) for aluminum cast at 750 F.

The general scheme (Fig. 2) was that the metal, as it advanced, would complete a series of electrical circuits, thereby lighting lamps which would show visually both time and location. Sixteen lamps were arranged in a line, with their terminals buried in the mold wall where flow was to be detected.

The terminals were iron wires 0.3 mm in diameter, set flush to give little disturbance to the metal flow. Some were in the cope and others in the drag.

The terminals of the outer two lamps in the line were led through a pendulum over a mercury vessel; they blinked once a second. The lights were recorded on a rotating drum (Fig. 3).

In the sand mold shown in Fig. 4, sprue diameters were 20, 30, 40, and 50 mm. Molten aluminum was kept in the basin and cast at 750 F by removing a stopper. Terminals a through e were in the drag, roughly opposed by terminals a′ through e′ in the cope. Time for the aluminum to flow from o to the various terminals is shown in Table 1.

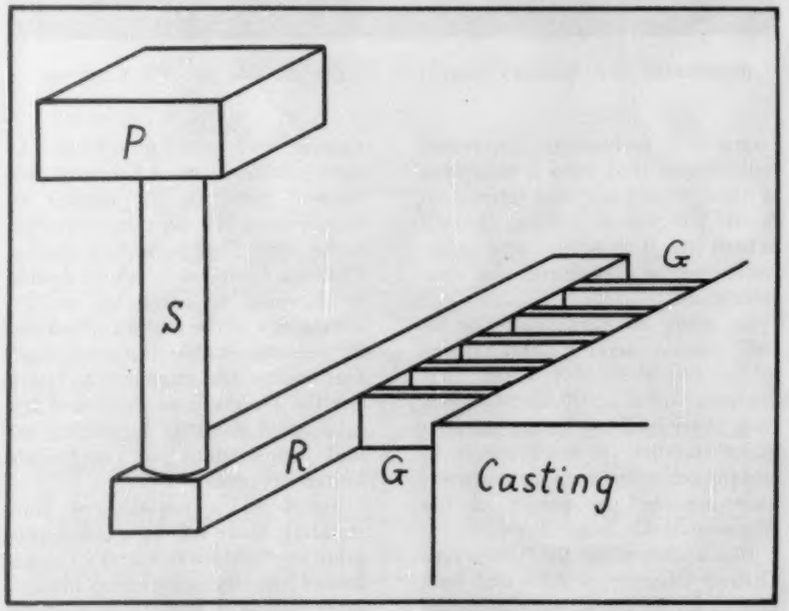


Fig. 1 . . Test sought data on the flow of metal in gates and runner.

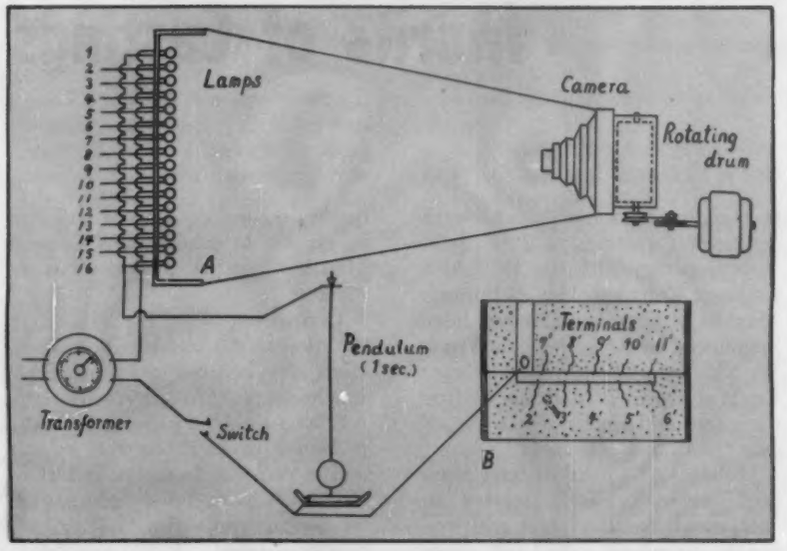


Fig. 2 . . Laboratory equipment set up to conduct the metal flow study.

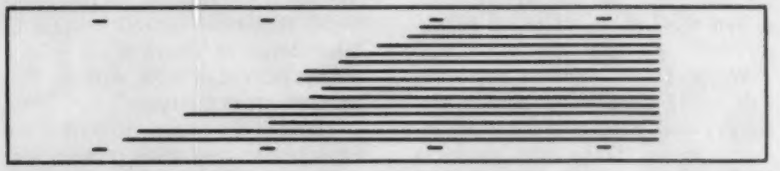


Fig. 3 . . Paper strip on rotating drum recorded lighting of bulbs.

TABLE 1 . . CONTACT TIME IN SECONDS FOR MOLTEN METAL AT EACH POINT IN FIG. 4

	a	b	c	d	e
20*	.50′	.49′	.40′	.47′	.38′
	0	.09	.12	.21	.28
30	.32′	.31′	.21′	.17′	.16′
	0	.08	.10	.12	.14
40	.05′	.14′	.15′	.17′	.12′
	0	.01	.07	.08	.11
50	.03′	.05′	.10′	.14′	.16′
	0	.02	.08	.10	.15

* Diameter of sprue in mm. Primed numbers are for upper contact.

The actual metal flow is shown in Fig. 5; when the ratio of sprue sectional area to runner sectional area was 0.70 and 1.7, the metal flowed with a free surface. When the ratio was 2.8, the metal filled the total section but had a slope at the head of the flow. When the ratio was 4.4, metal filled the whole section.

Gates Change the Picture

In the mold shown in Fig. 6, tests were made with from two to five gates. Touching times of flow-

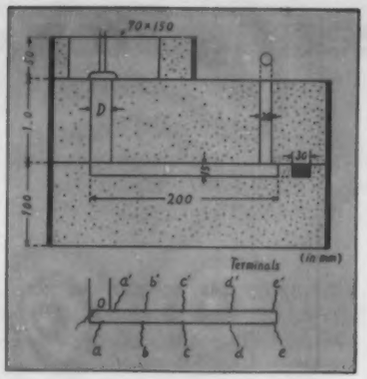


Fig. 4 . . Mold and terminals.

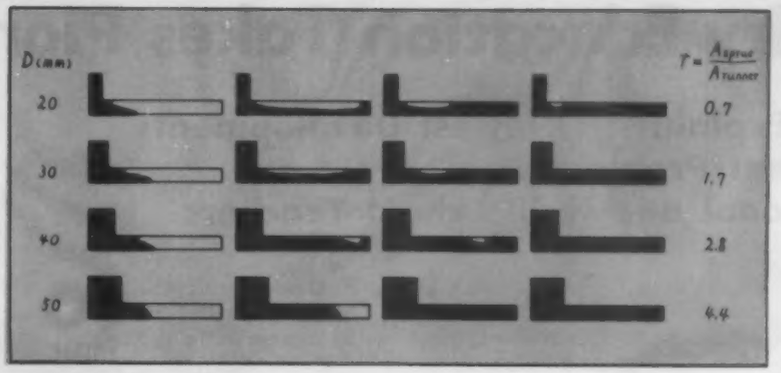


Fig. 5. . . Appearance of metal flow as cross section ratio varied.

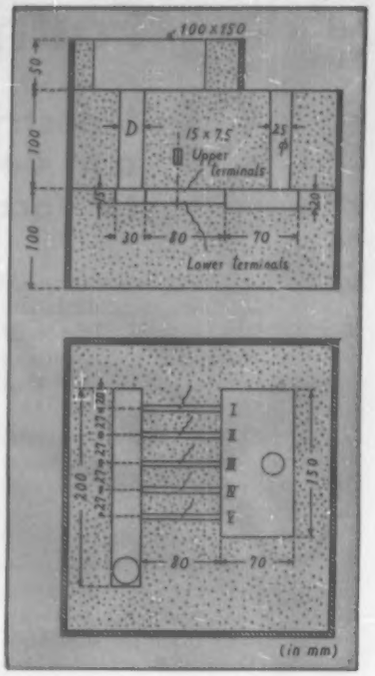


Fig. 6 . . Touching-time test.

ing metal to the upper and lower surfaces of each gate and casting were measured. Tables 2, 3, and 4 show the results, which varied as the sprue diameter varied.

With a 20-mm sprue, metal filled a three-gate casting rather uniformly. When more gates were added, it flowed with a free surface until the casting was entirely filled. Gates nearer the sprue were filled earlier than the farther gates.

With a 30-mm sprue, there was one major difference. The farther gate was filled before the gate nearer the sprue. The same was observed with the 40-mm sprue.

Finally, a stepped runner was tried—that is, one diminishing its section at each gate. Here the metal filled all the gates as shown in Table 5.

Several points are quite evident from this investigation.

- Metal flows with a free surface in a runner unless the ratio of sprue cross section to runner cross section is above a certain minimum.
- When a runner has many gates, too large a sprue lets the farthest gate fill first; a smaller sprue lets the near gate fill first. There is evidently a proper sized sprue that will let all gates fill uniformly. In this case, the ratio falls between 0.7 and 1.7.
- If the total cross sectional area of the gates is three-fourths that of the runner, metal will flow filling every gate in the casting. (In this investigation, each gate had one-quarter the section of the runner, and all three-gate molds filled completely.)
- With a stepped runner, metal enters the gates uniformly even though the above rules do not apply.

Acknowledgements. The author would like to express his thanks to Prof. I. Igarashi, Tohoku University, under whose instruction and guidance the investigation was carried out. He also wishes to thank J. G. Kura, Battelle Memorial Institute, who helped make this publication possible.

TABLE 2 . . CONTACT TIME IN SECONDS FOR MOLTEN METAL FOR D=20 MM

Gates	I	II	III	IV	V	Casting
5	2.11′	2.04′	2.06′	1.98′	0.62′	1.87′
	0.31	0.38	0.42	0.53	0.58	0.40
4	0.48′	0.40′	0.35′	0.30′	-	1.72′
	0.17	0.18	0.26	0.28	-	0.20
3	0.17′	0.23′	0.30′	-	-	1.64′
	0.13	0.20	0.22	-	-	0.22
2	0.25′	0.34′	-	-	-	1.45′
	0.14	0.14	-	-	-	0.20

Primed numbers are for upper contact.

TABLE 3 . . CONTACT TIME IN SECONDS FOR MOLTEN METAL FOR D=30 MM

Gates	I	II	III	IV	V	Casting
5	0.24′	0.31′	0.37′	1.01′	1.01′	0.98′
	0.20	0.22	0.29	0.33	0.38	0.32
4	0.23′	0.25′	0.32′	0.63′	-	1.00′
	0.21	0.22	0.28	0.27	-	0.33
3	0.20′	0.19′	0.18′	-	-	1.07′
	0.17	0.19	0.18	-	-	0.40

Primed numbers are for upper contact.

TABLE 4 . . CONTACT TIME IN SECONDS FOR MOLTEN METAL FOR D=40 MM

Gates	I	II	III	IV	V	Casting
5	0.15′	0.30′	0.41′	0.57′	0.75′	0.73′
	0.15	0.22	0.20	0.22	0.24	0.33
4	0.25′	0.30′	0.42′	0.97′	-	0.94′
	0.15	0.20	0.22	0.19	-	0.37
3	0.12′	0.15′	0.17′	-	-	1.00′
	0.10	0.13	0.15	-	-	0.40

Primed numbers are for upper contact.

TABLE 5 . . CONTACT TIME IN SECONDS FOR MOLTEN METAL IN STEPPED RUNNER

	I	II	III	IV	Casting
20*	0.28	0.28	0.43	0.47	1.46
	0.26	0.25	0.31	0.31	0.41
30	0.29	0.35	0.30	0.38	1.01
	0.22	0.22	0.24	0.22	0.45

* Sprue diameter in mm. Primed numbers are for upper contact.

Bibliography

1. Petin, J., "Die Giesstechnik fur Gusseisen in Theorie und Praxis," *Giesserei*, v 26, 1939, p 497.
2. Lehman, R., "Aus der Praxis der Anschnittechnik," *Giesserei*, v 28, 1941, p. 197.
3. Swift, R. E., J. H. Jackson, and L. W. Eastwood, "A Study of the Principles of Gating," *Transactions*, AFS, v 57, 1949, p 76.
4. Grube, K., and L. W. Eastwood, "A Study of the Principles of Gating," TRANSACTIONS, AFS, v 58, 1950, p 76.
5. Eastwood, L. W., SYMPOSIUM ON PRINCIPLES OF GATING, American Foundrymen's Society, Des Plaines, Ill., 1951, p 25.
6. Johnson, W. H., H. F. Bishop, and W. S. Pellini, "Velocities and Volume Rates of Metal Flow in Casting Systems," TRANSACTIONS, AFS, v 61, 1953, p 439.

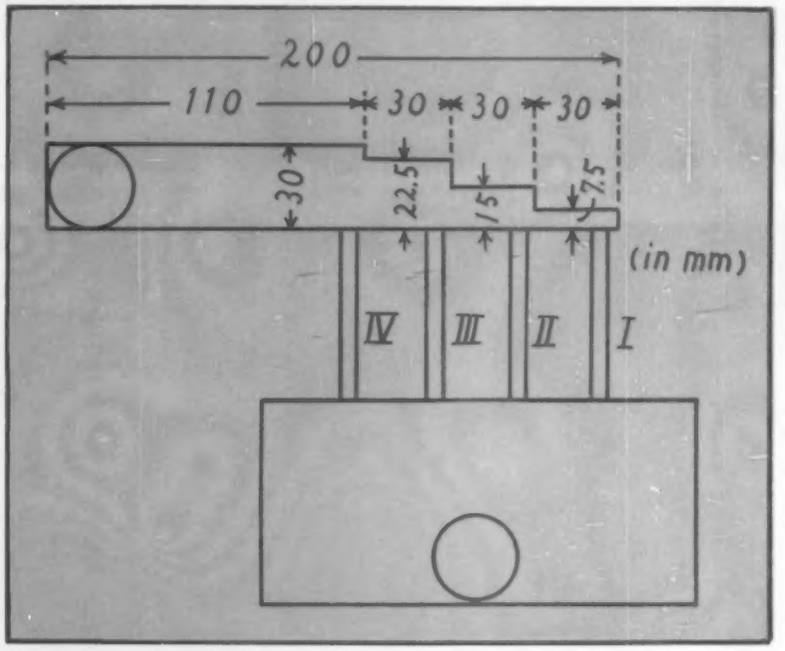


Fig. 7 . . Metal filled all the gates when stepped runner was used.

Foundry Education Takes Pioneering Step at

Industry Explains Its Newest Developments and Current Problems to Vocational and High School Teachers

Foundry and patternmaking instructors from vocational and high schools in the middle west gathered at the Kellogg Center of Michigan State University, East Lansing, Mich., June 14-16 to hear of the casting industry's advancing technology and of its requirements for personnel trained to work with this technology.

A program to accomplish these goals was presented as the 1956 Foundry Instructors Seminar, sponsored by the American Foundrymen's Society and its education division. Over 100 attended the seminar, first of its kind ever held.

To get a full picture of program, MODERN CASTINGS assigned a photographer to follow one of the teachers through the activities. The pictures on these pages will give you an idea of the program in which photo subject, John J. Pauly, Sr., Harrison High School, Chicago, and 102 others participated.

Thursday, Seminar Opens

After each conferee had registered, he had an opportunity to study the kit of materials with which he was provided. This kit included a textbook on foundry technology, outlines of the apprentice training programs at the Caterpillar Tractor Co., brochures describing new casting processes.

An official welcome from Harry W. Dietert got the seminar underway. Dietert is vice-president of the American Foundrymen's Society and a former university instructor.

Next step in the program was a review of "Progress in the Metal Castings Industry" presented by H. J. Heine, AFS technical director.

Changes being made in the castings industry by the introduction of automation were explained by F. G. Sefig, International Nickle Co., who noted that automation will broaden the scope of the foundry worker and will make necessary a new set of technically trained employees.

Luncheon speaker E. J. Walsh outlined "The Place of FEF in the Foundry Industry."

The afternoon program featured C. C. Sigerfoos, Associate Professor of Mechanical Engineering, MSU, whose talk, "University Training of Engineers for Foundry Work," told how a university carries on training for careers in the castings industry.

Following Professor Sigerfoos, B. L. Bevis, Caterpillar Tractor Co., discussed "In-Plant Training of Foundry Personnel." Based on the apprentice training program in effect at his company, Bevis's talk outlined a program that follows the philosophy of "select carefully and then pour it on."

At the conclusion of the afternoon program the teachers boarded buses and left for the Saginaw Malleable Iron Plant, at Saginaw, Mich. Executives of the Central Foundry Division, General Motors Corp., plant led the teachers on their tour of the massive plant.

The Saginaw trip was not the only opportunity the instructors had to see a modern foundry because the Whiting Corp. provided a working model of a plant which was set up outside the conference room.

Friday, Teachers Talk

The first item on Friday was a panel discussion, "Planning and Equipping the School Foundry," carried on by A. C. Hensel, Albion Malleable Iron Co., Albion, Mich.; G. Avery Aten, Battle Creek High School, Battle Creek, Mich.; and National Malleable & Steel Castings Co., Indianapolis.

To explain some of the functions of the sponsoring group, H. J. Weber and Wm. W. Maloney spoke on behalf of AFS. Weber discussed "Foundry Safety and Community Relations," and talked about "The Work of AFS in the Castings Industry."

Luncheon speaker Richard Sullivan, Dept. of Commerce, University of Wisconsin, presented the latest information and thinking on the "Effect of Automation on Industrial Employment."

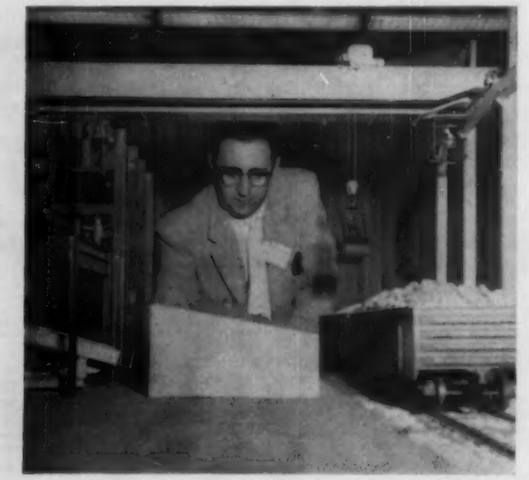
In the afternoon a panel discussion on the "Availability and Use of Instructional Materials," was presented by C. F. Schuller and H. C. Hartsell, Michigan State University, and W. P. Winter, Pennsylvania State University.

The final event of the afternoon was a talk on "Industrial Training

AFS brass was on hand and hard at work during this pioneering educational meet.

Displays of work done in other school labs give a teacher fresh ideas and new values.

Working model and trip through large plant let teacher know how industry is doing it.



AFS Seminar

Studying the kit of materials is the first order of business for Teacher Pauly and colleagues.

in the Schools and Coordination of the School Program and Industry," which was presented by R. A. Oster, Beloit Vocational School, Beloit, Wis., a national director of AFS.

At dinner, the conferees listened to Dr. C. L. Greiber, past president of the American Vocational Association, speak on "The Future of Vocational Education for Industry."

Saturday, the Shakeout

Saturday, the wind-up day, was devoted to a double-barreled discussion of the development of a foundry course to meet the needs of local foundry industry. A four-man panel discussed "The Foundry Course in a General Shop Program." Panelists were: R. E. Crabbe, Senior High School, Springfield, Ohio; H. W. Krueger, Algonac Community Schools, Algonac, Mich.; C. C. Sigerfoos, MSU; and Robert Speerbrecher, Wisconsin Vocational Schools, Greendale, Wis. A discussion of "The Foundry Course in a Vocational Program," was presented by Howard W. Smith, Chicago Board of Education.

Final event of the seminar was the "Shakeout", a question session moderated by W. H. Ruten, Polytechnic Institute of Brooklyn, chairman of AFS's education division.

Following the "Shakeout" the seminar was officially adjourned, but the Michigan State foundry lab held an open house during which many of the instructors examined the MSU facility.

While no definite plans have been announced, AFS officials indicate that another seminar will be held next year.

Shakeout period gave John Pauly a chance to get his questions answered.

Word on planning and equipping a school foundry was given by men who know from experience.

C. C. Sigerfoos shows Pauly some of the equipment used to teach foundry to engineering students.

WHAT THE PURCHASING AGENT SAID TO THE FOUNDRYMAN . . .

A chance to see your job from the other side of the desk

ROY H. WEBB / *Purchasing Agent*
Templeton, Kenly & Co.
Broadview, Ill.

Because our company purchases castings from 21 different foundries, we have tried earnestly to become acquainted with their problems. To me, a salesman representing a foundry should be foundry trained and know something beyond a casual knowledge of what a casting looks like. He should have spent some time in actual foundry work—patterns, cores, molding, melting, pouring, cleaning, and costing.

He should be really interested in his foundry and know its limitations, its competitors, and the other products that affect its efforts. Before making a call on any account he should know just where that customer's orders stand, on schedule or behind. He should be customer-minded enough to keep posted, not just an order-taker doing as little as possible.

In our efforts to improve our own products, we make every effort to help our suppliers. We keep an accurate description of our pattern equipment and flask size requirements, plus a record of corrections or changes by date so that we can always pull out a blueprint of the part for discussion. It is our policy to improve the equipment offered for production as rapidly as possible, commensurate with changing foundry practice and business. We believe that our over-all equipment is as good or better than the average as a result. We are willing to furnish marked blueprints of each part, which indicate critical dimensions and surfaces.

In return, we expect just one thing from our suppliers—the very best possible casting with the equipment furnished. Some of the things that we have had costly experience with are pattern shifts, core shifts, and the famous pig iron moth as well as dirt inclusions. Causes? Inexperienced molders, poor supervision, careless quality control, inspection—everyone has a different answer.

Here is my theory for improvement of relations:

- Have a good production manager who understands the scheduling of the various machines and has the cooperation of all producing departments. After a purchase order has been placed and accepted, the customer is only interested in delivery. This is a production problem and not a sales problem. In this the production manager must be a key figure. His operation should be closely tied into general sales policy.
- Cores are extremely important in a large percentage of castings and should be thought of as such. Made per core box, pasted correctly, and gauged for proper dimensions, the molding department at least has the proper equipment to start their part of the program.
- The molding, venting, and coring of a job should, I think, be a relatively simple matter after experimental work has developed a proper, sound casting. Too often we find this is not the case. A molder anxious for extra pay can slough the necessary operations. A clean mold, properly placed cores, properly closed and properly handled molds to eliminate cope and drag shifts can produce a good casting. The foreman should be watchful of these details because, after the mold is closed, the result is set.
- In the pouring of the casting, it is important that the man with the ladle know each job. Never partially pour a mold—you know it has been done. The molding department should at all times be zealous for good castings. It is costly for the cleaning department to try a cover up to save poor foundry practice. The extra cleaning or scrapping of castings adds to your costs and finds its way to us via increased prices—which we don't want.
- In the final finishing of casting, we look to inspection to check the casting against our blue prints and to cull substandard ones out. Why ship bad castings to the customer, adding extra freight, only to have them rejected with additional return freight and a black mark in the customer's file?

To help our company and our suppliers, we welcome having key personnel visit our plant so they may see why there is a necessity for quality control. I, in turn, have taken our men into foundries for better understanding of your problems. We like to know our suppliers and they us, for this develops a better working relationship.

In the long run we all receive what we have earned. Good products beget additional orders—poor products lose orders.

Condensed from an address given before the recent Market Development Conference of the Malleable Founders' Society.

THE CO_2 PROCESS

U. S. and British foundrymen differ in their enthusiasms about CO_2 but expansion of new process seems certain.

A MODERN CASTINGS BONUS

This 16-page special insert has been prepared by the editorial staff because of widespread current interest in the CO_2 process.

VARIOUS STAGES of producing a standard for a weighing machine are shown. Top to bottom, two halves of the core; gassing the core; removal of core from box; inserting core into mold. Note quality of the finished casting.

K FOR PLANT SITE

als can be tricky panding industry

eteorological factors. There is h concern today about air pol-n—for which industry and merce is pretty generally ed. Those of us in industry it is impossible not to release rtain amount of impurities to air. The complaints are very y to arise in areas repeatedly ect to temperature inversion—eteorological phenomenon.

amount of control or the fin-f equipment will eliminate all ulties in such areas; hence the pective industrialist s h o u l d k with the weather bureau and ss his problems. If tempera-inversions are a factor he ld cross the locality off the list.

ansportation facilities. We mentioned that the plant area

Two-way blast nozzle cores are made by CO_2 process at Oklahoma Steel Castings Co. About 60 per cent of foundry's cores are made by CO_2.

What North American Foundries Have Learned About CO_2

New process gives excellent quality but disadvantages include failure to adapt to high production foundries.

■ The CO_2 process is being used for the production of a wide range of castings, both ferrous and nonferrous, in its first year of introduction into America. Only time will tell if this process can be satisfactorily adapted to high-production work.

These conclusions and the information which follows were developed by the Core Test Committee of the AFS Sand Division. The committee undertook an objective evaluation of the CO_2 process as used in the United States and Canada, completing its survey in March 1956.

■ **Advantages** reported by foundries are:

1. No baking ovens or core driers needed and more capacity from the same floor space.
2. More accurate dimensions and smoother finish on the casting.
3. Less gas evolution and good shakeout.
4. Eliminates mold drying.
5. Rapid production of finished cores to expedite rush orders.
6. Saves money and space.
7. No odor or smoke from the process.
8. Cores can be hollowed out before gassing to make shell cores.

■ **Disadvantages** reported are:

1. Stickiness in the core box.
2. Poor workability of the sand.
3. Poor shakeout.
4. Poor handling-ability and loss of hardness of cores on storage because of moisture adsorption.
5. At present this process is not adaptable to high-production foundries.

To make the evaluation, the committee distributed questionnaires to more than 100 foundries all over the United States and Canada, representing all fields of casting production. Twenty one questionnaires and nine letters were received from 30 shops in 10 states and Canada. Most of the foundries reporting are jobbing shops, some are semi-production shops. No high rate of production of cores or molds by the CO_2 process was reported.

The 21 questionnaires included information on 26 different castings. Of these, five were steel (both carbon and high alloy), nine were gray iron, four malleable, four brass and bronze, three aluminum, and one nickel.

The wide range of application of the CO_2 process for hardening cores and molds is further demonstrated when each metal is examined by itself:

Steel castings varied in weight from one to 100 lb and included such castings as grader arms, pump castings, and trailer wheels with section sizes rom ¼ to 3 in. and a reported tolerance of 1/32 in.

Gray iron castings weighed from 5 to 5000 lb, increasing in size from wheel bearings and spacer spools, valve bodies and gear cases, to lathe beds and machine tool bases. Section sizes varied from ¼ to 3 in. with the best reported dimensional tolerance of 1/128 in.

Malleable. The same tolerance of 1/128 in. was given as possible for malleable castings which varied in section size from 1/8 to 2 in. and in weight from two to 100 lb. These castings include truck and railroad parts and pressure valves.

Brass & Bronze. Pressure castings, pump fittings, and meter housings weighing from three to 20 lb with section sizes from ¼ to 2½ in.

Aluminum castings for aircraft parts, meter bodies, and pressure castings weighing from 2 oz to 200 lb. Best tolerances reported were 0.01 to 0.03 in. Sections sizes varied from 1/8 to 1 in.

■ **How Sand Was Packed.** In the specific jobs reported, six molds and 26 cores, of which six were listed as external cores, were hardened by CO_2 gas. The cores were made as follows: 10 by hand ram-

ming, five by blowing, three by jolting. For the molds: two were hand rammed, three were made on molding machines, and one was slinger rammed.

■ **Mixtures and Washes.** While 15 foundries reported no facings used, three shops were using regular core sand for facings. Fifty nine per cent of the foundries reported no washes needed. Of the foundries using washes, three reported using water-base washes and eight reported using alcohol-base washes; two foundries were using both types.

Dry sand with less than 0.8 per cent AFS clay were specified. Grain size numbers varied from 50 to 115 AFS GFN, while sand temperatures were all listed as room temperature with a maximum allowable temperature of 100 F. These wide variations in fineness and desired physical properties cause considerable difference in sand mixtures from foundry to foundry.

Amounts of sodium silicate binder used varied from 2-3/4 to 6 per cent by weight of sand.

■ **Additives.** One aluminum, one steel, and four gray iron foundries reported using only sodium silicate binder, while the following materials were used by one or more foundries:

To Improve Collapsibility
Asphalt Emulsions
Cellulose Fibers
Cereal Binder
Gilsonite Compound
Graphite
Sea Coal

To Improve Surface Finish
Gilsonite Compound
Silica Flour
Iron Oxide
Graphite
Sea Coal

■ **Mixing.** Majority of the foundries reporting use a wheel-type mixer for silicate-bonded sands. Average mixing cycle is: mix the dry ingredients for 1 min, add the sodium silicate binder and mix an additional 4 min for a total cycle of 5 min. Moisture content of the mixed sands ranges from 2 to 4 per cent.

■ **Bench Life.** Unless covered, the bench life of these sands is ½ to 3 hours. Local conditions of temperature, humidity, air movement, and the amount of carbon dioxide in the atmosphere are the determining factors on bench life.

■ **Drying.** One foundry oven-dries internal cores, two others oven-dry their washed cores, but 85 per cent reported they were not oven-drying their CO_2-hardened cores and molds.

■ **Properties.** Surface hardnesses of 80 to 95 scratch hardness were listed as were tensile strengths of 35 to 115 psi on the hardened cores. Other questionnaires stated the hardness and tensile strengths were less than those of corresponding conventional core sands. Six foundries mentioned there was less gas evolution from the silicate-bonded sands than from their regular core sands.

Collapsibility of the CO_2-hardened sands is adequate when burnout additives are used, and the majority stated they had no shakeout problems.

■ **Gassing.** Methods reported for gassing the cores and molds were all manual and included the use of rods, cups, vents, gasket seals, etc. Seven foundries found it necessary to have special venting in their patterns or boxes.

Both the gassing pressures and the amounts of gas used per unit amount of sand varied widely. Gassing pressures from eight to 50 psi were given and foundries reported gassing from eight to 120 lb of sand per pound of gas, a 15-fold difference.

■ **Storage.** Cores and molds hardened by CO_2 are stored from 15 minutes to four weeks before pouring. Moisture pickup on stored cores gave 44 per cent of the foundries trouble and one shop discontinued using the process because of this problem.

■ **Contamination.** Seven foundries reported returning the silicate-bonded sands to their sand system without reclamation, but only one of these returned the silicate sand to core sand. None of the foundries reported contamination of their sand by sodium carbonate and some had been reusing the silicate sand for as long as six months. None of the foundries reported using a sand reclamation unit.

■ **Costs.** Sand mixture costs vary appreciably, from a low of 0.7c per 6-lb core to a high of $30 per 200-lb mix. The majority of foundries reporting on the costs of these silicate sands said they were somewhat higher than their conventional sand mixtures.

Cost of the CO_2 gas varied from 4c to 15c per pound. Only two foundries were using CO_2 gas generators while 18 reported using bottled gas. Sixty one per cent said it was not necessary to heat their CO_2 valves. One foundry stated that the use of extra-dry carbon dioxide eliminated the need for heating the valves.

Members of the AFS Core Test Committee from whose report this summary was adapted are: J. E. Huss, Lauhoff Grain Co., Danville, Ill., **chairman**; W. M. Peterson, M. A. Bell Co., St. Louis, Mo., **vice-chairman**; C. F. Walton, Gray Iron Founders' Society, Cleveland, **secretary**; F. S. Brewster, Brumley-Donaldson Co., Huntington Park, Calif.; W. H. Buell, Aristo Corp., Detroit; Harry W. Dietert, Harry W. Dietert Co., Detroit; H. E. Donnocker, Ottawa Silica Co., Ottawa, Ill.; G. M. Etherington, American Brake Shoe Co., Mahwah, N. J.; B. Freedman, Monsanto Chemical Co., Springfield, Mass.; J. A. Gitzen, Delta Oil Products Co., Milwaukee; C. J. Jelinek, Ford Motor Co., Cleveland; Burdette Jones, John Deere Waterloo Tractor Works, Waterloo, Iowa; D. S. Mills, General Motors Corp., Detroit; R. J. Mulligan, Archer-Daniels-Midland Co., Minneapolis; E. J. Passman, Frederic B. Stevens, Inc., Detroit; V. M. Rowell, Harry W. Dietert Co., Detroit; C. E. Schubert, University of Illinois, Urbana, Ill.; G. F. Watson, American Brake Shoe Co., Mahwah, N. J.; E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit; and E. C. Zirzow, Werner G. Smith, Inc., Cleveland.

Core box is inserted into combination gassing-roll-over machine. CO_2 is blown during roll-over.

Process is being rapidly adopted for both cores and molds of castings up to 20 tons

D. V. Atterton

Foundry Services, Ltd., Birmingham, England. Exchange Paper from The Institute of British Foundrymen to American Foundrymen's Society.

Survey of CO_2 Developments in Great Britain

When descriptions of a process for hardening molds and cores with carbon dioxide were published in various German and Eastern European journals, the majority of British foundrymen were, to say the least, very skeptical. After an extensive laboratory investigation, we carried out the first major foundry trials in Great Britain in conjunction with a foundry.

A few foundrymen soon realized the great potentialities of the process and made such rapid strides with its development that, within a matter of a few months, the majority of their molds and cores were being hardened by carbon dioxide.

From then onward, the process has been rapidly adopted by many foundries for castings ranging from light alloy to alloy steel and from a few pounds to more than 20 tons in weight.

The principle of the process, as used today, was described in a British Patent of 1898 taken out in the names of two Lancashire chemists, Hargreaves and Poulson; however, probably because all foundry sands used at that time for both molds and cores were naturally bonded, the idea of a synthetically-bonded sand involved such a radical change of outlook that apparently no foundry trials were even carried out.

Condensed from a survey of the technical and practical developments of the carbon-dioxide process in Great Britain.

There can be no doubt that even greater benefits of the process have yet to be realized and much further progress will be made with developments of new binders and gassing techniques. However, it must be emphasized that the process is in no way a remedy for bad foundry practice nor is it adaptable to universal application.

Advantages and Limitations

■ **1.** There is no necessity to bake the mold or core if a suitable composition binder is employed. Elimination of this delay means that much better delivery can be given to meet urgent requirements of customers, and it is not uncommon for the pattern for quite moderate size castings to be received in the foundry in the morning and for the casting to be dispatched on the same day. Also, the problems of synchronizing the production of core shop and casting bay are considerably simplified.

Other advantages resulting from the absence of baking are the elimination of binder and core oven fumes, of doubts as to whether cores are under or over-baked and of bottlenecks in production due to limited oven capacity.

■ **2.** There is no necessity for core carriers when the core is hardened by carbon dioxide in the box. In addition, the use of strengtheners and irons in molds and cores can be eliminated when these are normally employed to impart rigidity in the green state.

When strengtheners are added to give support in the dry state, such as in the neck of a barrel core, these should not be removed or reduced. The process also results in greater dimensional accuracy since the distortion that can occur with conventionally bonded sands in the green state or during baking is eliminated. There is an additional benefit in that cores no longer have to be rubbed down to fit into prints.

■ **3.** Cores and molds made by the process can be stored almost indefinitely as long as due care is taken with the sand mixture and with the method of gassing, as outlined later in the paper.

■ **4.** A unit sand may be used throughout the foundry. A large iron foundry producing a wide range of castings now uses a unit mixture of 3½ per cent binder, 1 per cent pelletted pitch in a sand of AFS fineness number 75 for both cores and molds with the addition of 1 per cent of a proprietary clay binder to the mix on those occasions when green strength is required. Talbot states that in his foundry the same mix is used for heavy or light work in iron, gunmetal, and brass.

■ **5.** Transport costs are markedly reduced with the process primarily because there is no longer any need for baking and also because cores can often be prepared adjacent to the mold. It is fairly general in

foundries producing heavy cores that about six crane lifts are saved per core. One foundry producing daily twenty 500-lb castings has found a saving of 140 crane lifts and consequently less time wasted in waiting for cranes.

■ 6. There is a considerable increase in casting output from available floor space. Instead of a mold occupying floor space for days while cores are being prepared and baked, the fully cored-up mold can be completed in a much shorter space of time and the job cast. For smaller castings, book-type molds are readily prepared and no molding boxes are required; the technique of stacking or clamping book molds between fixed divisions on the foundry floor is already being practiced.

■ 7. There is considerably less danger of blowing with CO_2 molds and cores except in the case of light alloys. This is due to appreciably higher permeability and the much lower volatile content of CO_2 sands compared to oil or resin sand mixtures. The lower volatile content also results in a marked reduction of obnoxious fumes in the foundry during casting with consequent better working conditions.

By adopting the carbon dioxide process, fumes in one foundry were reduced to such an extent that the need for fume extractors no longer existed.

■ 8. On steel castings, in particular, it seems that there is a reduced incidence of both hot tears and scabs. The main reason for this is probably the high plasticity of the surface layers of sand at elevated temperatures so that the sand yields under expansive and compressive stresses and thus prevents the formation of scabs and hot tears respectively. There is also moderate evidence to show that contraction is much less restricted with CO_2 sands and that castings are consequently much more free of internal stresses; if this work is substantiated, patternmakers' allowances for steel castings might have to be modified.

■ 9. After a certain amount of experience has been gained, cores and molds can be prepared by semi-skilled labor. Also, cores previously made in two halves and jointed after drying can now frequently be made in one piece.

Casting of leaded bronze bearing was made by CO_2 process. Photograph also shows the pattern equipment, mold and core.

Aluminum bronze casting made by process shows excellent finish. The cores and molds can be made by "semi-skilled" labor.

■ 10. One of the most attractive features of the process is the small capital outlay involved for carrying out experimental trials and introducing the process into a foundry. Also, the cost of sand mixes is often substantially lower than oil or resin sand, and the other advantages of the process make it possible to effect considerable savings in the production costs of castings.

The one main question that remains to be solved is that of sand reclamation and of introducing CO_2 sand into a green sand system; preliminary information suggests that green sand may tolerate quite moderate proportions of CO_2 sand without any deterioration in properties.

A preliminary examination of sand reclamation by wet methods is described later in this paper.

Excessive treatment with carbon dioxide results in deterioration of the strength of sand cores, particularly on standing; this phenomenon is known as "overgassing" and is generally characterized by the appearance of whitish crystals of sodium bicarbonate on the core surface. It is not yet clear whether this material is responsible for the ill effects of "overgassing" or is simply coincidental. However, it forms a most useful indicator for the onset of "overgassing." In all probability, the cause of "overgassing" results in the loss of water from the gel.

Sodium bicarbonate is formed even with only 15 seconds gassing and, from this, it would seem that moderate sodium bicarbonate contents may be tolerated before the commencement of overgassing effects.

Naturally, the binder composition has been so adjusted that there is moderate latitude to gassing times and no substantial depreciation was observed until the core gassed for three minutes.

The marked increase in strength of correctly gassed cores on standing is, in all probability, primarily associated with the residual binder undecomposed by the treatment with carbon dioxide. Such residual binder sets even harder on standing or baking at temperatures of 212-392 F due probably to general moisture evaporation and to dissolution of silica sand and of silica gel, leading to the formation of a glassy bond. Silicates in contact with normal sands for quite short periods have been found to increase substantially in silica content and viscosity.

The optimum gassing procedure is to treat the core with gas until the initial rapid increase in strength is obtained and the core is sufficiently rigid to handle; any further gassing is wasteful and generally deleterious. Although there is a considerable latitude in gassing so that even treatment times of more than one minute at typical flow rates still generally produce

a very satisfactory core, the 20-20 rule suggested by Talbot of having 20 seconds gassing at 20 psi pressure is to be strongly recommended for general foundry work.

General physical properties of CO_2 sands are comparable with those of conventional oil or resin sands but certain properties, such as permeability and gas evolution, show marked differences.

So far, the process has been found satisfactory for bonding a wide range of silica sands and also zircon and chamotte/silica sand mixes; it is preferable for the sand to be clean, cold, dry and free from active clays and, unless otherwise stated, the properties quoted here have been obtained with such a sand.

▪ **Preparation of sand.** The general technique is to mix the dry sand and any powder additions, such as coal dust or pelletted pitch, for about one-half to one minute and then add the viscous binder and mix for two to four minutes.

As long as the mixing is thorough, the type of plant employed is not critical; essentially, only a simple mixing operation is required as it is generally not necessary to develop any green strength in the mix.

The gassed strength of the sand varies slightly depending on the type of mixer or mill employed. This is probably due to a certain amount of premature hardening of the binder by reaction with carbon dioxide in the atmosphere during vigorous milling.

▪ **Hardened strength.** The compressive strength obtained with most sands immediately after gassing is of the order of 200 to 300 psi and this increases under favorable conditions to about 500 to 700 psi on standing in a normal foundry atmosphere for several days. However, it must be emphasized that cores and molds are perfectly suitable for casting immediately after gassing. The strength figures obtained are certainly less than have generally been accepted for many where compressive strengths as cores bonded with oils and resins high as 1200 psi are not exceptional. However, except for such applications as centrifugal casting, it is generally agreed that such strengths are unnecessarily high and the carbon-dioxide process has been instrumental in establishing this point. It should be added that strengths well in excess of 1000 psi may be obtained if CO_2 sands are given a slight baking at temperatures in excess of 230 F.

The actual gassed strength depends upon a large number of variables but, assuming that a dry, cold, clay-free sand is used, compressive strengths of between 200 to 300 psi are obtained in less than one minute gassing time.

Overgassing was not appreciated in the early days of the process when it was quite a common but fallacious practice to be lavish with gas application if it was desired to obtain a particularly hard core. However, an overgassed core can be readily recognized by the appearance of whitish crystals or powder on the sand surface; cores or molds showing such a white deposit are invariably found to be friable.

On standing, cores that have been correctly gassed to obtain the initial set show an appreciable increase in strength. Thus, in a matter of a few hours, there is a marked increase in compressive strength and scratch hardness, followed by a falling off in the rate of increase but it is significant that the cores continued to increase in strength properties even after 14 days; this is confirmation of the advantage claimed with regard to core storage.

Certain cases have arisen where cores that have been correctly gassed have markedly deteriorated on standing. This has occurred primarily with cores that have been stored in sulphurous atmospheres and analytical investigations have shown that such friability is due to the absorption of sulphur dioxide from the atmosphere.

▪ **Certain impurities** in the sand can appreciably alter the hardened strength obtained and result in friable cores particularly on standing. The two main deleterious properties are moisture and active clays such as bentonites and, to a lesser extent, ball clays.

The initial set strength of the sand is not drastically reduced by the presence of small amounts of moisture but the strengths on standing decrease rapidly causing the cores to become friable and unusable. It is of academic interest that the cores do eventually, after about a week, begin to pick up again in strength; this no doubt occurs after the water present in the core has evaporated and the residual binder present begins to thicken up.

In addition, the presence of water in the sand increases the danger of blowing defects on casting.

Similar deteriorations in strength properties are obtained with the presence of active clays in the sand. There is a very detrimental effect from small quantities of bentonite and similar results, although much less severe, are obtained with clays of the ball- and fireclay-type. Consequently, the incorporation of small quantities of ball clay in the sand up to about one per cent is moderately satisfactory when it is desired to develop green

Cores can be stored almost indefinitely, British say. These are for light alloy castings.

Molds, cores and finished castings of gunmetal hopper show typical use of process.

strength; however, bentonite should never be used for this purpose.

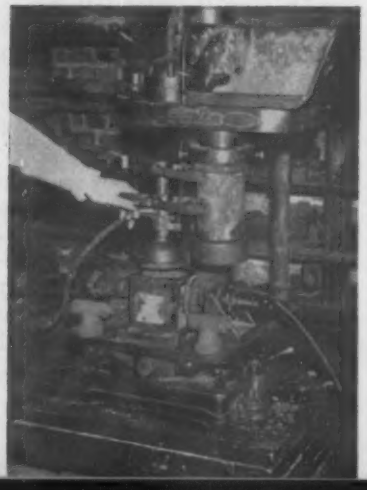
■ **Sand grading.** As with all binders, sand grading is of considerable importance in determining both the hardened strength and the minimum binder addition necessary to obtain satisfactory strength properties for foundry usage; a large percentage of fines in the sand tends to make cores and molds friable unless high binder percentages, such as 5 to 7 per cent, are used whereas with coarse sands, satisfactory strengths may be obtained with binder percentages as low as 2 to 3 per cent. However, for the majority of core and molding sands, a 4 per cent addition of binder is about the optimum quantity.

Optimum additions of binder from the point of view of strength have been determined by investigating the variation in strength with binder content when gassing AFS cores for a constant time. More than 50 sands have been examined in this way and it has been found that a moderately good direct relation exists between the optimum binder contents and the AFS grain fineness number of the sand.

■ **Sand temperature.** Hot sand causes a certain amount of premature hardening so that the sand tends to develop a certain amount of green strength and becomes unworkable. In addition, hot sand mixes tend to air-harden rapidly and it is for these reasons that cold sand is recommended.

■ **Green strength and flowability.** When the core or mold is hardened in the box or with the pattern in position, green strength is of little or no importance. The green strength of sands bonded with binders for use in the carbon-dioxide process is low, usually varying between 1/2 to 1 psi and depending upon the milling time, type of sand and on sand temperature.

Attachment on core blower permits gassing of cores in place. Early developments may need only small capital outlay.



However, for certain methods of gas application and when using poor quality pattern equipment, it is desirable to strip green and for such cases, green strength CO_2 binders have been developed; such binders give green strengths varying between 2-1/2 to 4 psi. Alternatively, materials such as ball clay or dextrin may be milled into the sand in quantities up to about one per cent with no appreciable deterioration in gassed strength.

For many of the applications where stripping green is desirable, many foundrymen have used the low green strength binder and have relied on the rapid formation of a hardened skin on the sand surface which prevents distortion.

The flowability of CO_2 sands in the ungassed state is high and values determined by the deformation test on the standard ramming apparatus are in the region of 80 to 90. These figures vary very little with the sand used or with increase of binder content.

The more informative shatter index test shows the sands to compare very favorably with highly flowable conventional core-sands; the shatter index figures obtained vary between about 60 per cent and 75 per cent depending upon the type of sand used and on the milling time but the binder content appears to have very little influence.

■ **Permeability and gas evolution.** The permeability of CO_2 sands is significantly higher than the same sand bonded with conventional binders. As with normal binders, a reduction generally occurs with increase in binder content. Increase in the time of gassing with carbon dioxide also results in a slight increase in permeability. One sand with an AFS fineness number 75 gave a dry permeability of 135 with a typical oil binder whereas the value with the recommended addition of the CO_2 binder was 172.

Steel spiked roll-crusher on knockout. Note strip of sand still adhering. Process has been very successful with steel.

In addition to this, the volatile content of CO_2 sands is very low being approximately one-third to one-quarter that evolved from normal core sands. However, with certain castings, the rate of gas evolution is of greater importance than the total gas content. At the low temperatures of light alloy casting, the rate of gas evolution is greater with CO_2 sands. Consequently, with castings having totally enclosed cores or with thin-section permanent mold castings, blowing defects may be more prevalent with CO_2 sands due to the evolution of gas before a solid casting skin has formed whereas, with an oil or resin core, little gas evolution may occur until a substantial thickness of metal has solidified at the metal-core interface.

Although this blowing difficulty has not occurred to any appreciable extent, it should be mentioned that it could be readily eliminated by a short baking at temperatures around 230 F as the majority of gas evolved is steam.

■ **Thermal properties.** Early work on the carbon-dioxide process suggested that the bonded sands might have a higher chilling power than the same sand bonded with conventional oil or resin binders. The apparent thermal conductivity of a sand bonded with the CO_2 binder is initially about five times as high as the same sand bonded with oil but that difference rapidly disappears on heating. This effect is due to the small quantity of moisture present in the sand which is eliminated by heating to about 212 F. This difference in conducting power is no doubt less than that between a green and a dry sand and probably would not be detectable on any castings but those of extremely thin section.

■ **Surface finish.** During the early

Double plated steel fly-wheel was cast in CO_2 mold. English castings have been made up to 20 tons in weight by process.

Another heavy casting is iron launder holder weighing more than 16 tons, Process gives excellent dimensional accuracy.

trials with the carbon-dioxide process on the foundry floor, considerable variation in surface finish of castings was observed. The two main variables, apart from the fineness of the sand, appeared to be the type of metal and the section thickness of casting. Now, with our general increase in knowledge of the process, the reasons for such variations are apparent and have resulted in the development of various techniques and special binders so that with iron and copper-base alloys where the surface finish was initially disappointing, very satisfactory finishes have been obtained.

With light alloys, the surface finish is equivalent to that obtained with conventional oil or resin binders. At the temperatures prevailing in light alloy castings, no chemical reaction occurs between the sand and the binder and the surface finish is a direct function of the sand-grain size and the degree of ramming. Where superior surface finish is required, conventional coatings based upon mica, talc etc. have been used most successfully.

At temperatures in excess of about 1475 F, any residual binder and sodium carbonate begin to react and sinter with the sand. Such sintering occurs to an increasing extent with increasing temperature and generally results in an increase in the size of pores between the sand grains at the mold or core surface and thereby results in a greater incidence of metal penetration.

As may be expected from conventional foundry sand practice, an increase in the fineness of CO_2 bonded sand results in an approved surface finish; also, in iron and copper-base foundry work, it is common practice to add carbonaceous materials to the sand in order to improve surface finish and these have been employed to considerable advantage with the carbon-dioxide process. Typical of such additions are coal dust, pelletted pitch, woodflour, asphalt, oil and also graphite; all of these have been employed with CO_2 sands but coal dust and particularly woodflour have the disadvantage of tending to produce friable cores and molds. Pelletted pitch, however, results in slightly improved strength properties particularly with regard to edge hardness of cores.

The results obtained in one experiment with coal dust show that an addition of about 6 per cent is approximately the optimum amount. The disadvantages of coal dust are that it gives rise to a moderate amount of fume and also encourages surface friability in cores; however, this material is used very successfully and extensively on a production scale as an additive to CO_2 sands.

Tests with pelletted pitch show that it is more efficient on a percentage basis in producing a good surface finish, and an addition of 2 per cent gives a surface comparable to that obtained with 6 per cent coal dust. In addition to the beneficial effect of pitch on sand properties, there is a reduced amount of fume compared to coal dust.

Naturally, the necessary amount of carbonaceous material for satisfactory surface finish depends upon the section thickness of the casting, the pouring temperature and the type of sand; the figures of 2 per cent pelletted pitch and 6 per cent coal dust should be considered as maximum amounts and smaller quantities are frequently employed for thin section work. This is illustrated by the following empirical rule which has been employed successfully by several foundrymen for section thicknesses in iron up to about two inches: *"An addition of a percentage of coal dust equal to twice the section thickness or a percentage of pelletted pitch equal to the section thickness is used."*

Some foundrymen have used additions of graphite to improve surface finish preferring this material because of the reduced amount of fume; however, although very good finishes have been obtained, the results seem more variable and graphite has the disadvantage of being relatively expensive.

When, as with conventionally bonded sands, a high quality surface finish is required, the use of coatings is essential unless very fine sands are employed. Graphite coatings, either carried in an inflammable or water medium, result in a great improvement in surface finish. Graphitic coatings have been found the most suitable for both copper-base and iron castings.

The surface finish obtained with steel is, in many ways, the converse of orthodox sand practice. With thin castings, up to 3/4 to 1 inch in section, the surface finish is generally not so good as that obtained with normal sands. However, with sections greater than 1 inch, there is a marked improvement in surface finish and many steel castings are now being made in CO_2 sands without the use of refractory silica or zircon dressings which were previously considered essential. This is due to the formation of a viscous slag layer at the metal-mold interface. Analysis of this slag shows it to be a ternary mixture of Na_2O-FeO-SiO_2 and the extent of its formation increases with both pouring temperature and section thickness of casting. Previous investigations have shown that the formation of such slags can be most effective in preventing metal

penetration and improving surface finish.

Where metal penetration has occurred with steel castings, conventional paints have been used successfully; in Germany and, to a lesser extent, in Great Britain, the rather surprising but very successful technique of coating molds and cores with thick water-base dressings that are simply allowed to air dry for periods of the order of ten hours has been found most successful. Also, as with conventional sand mixes, the incorporation of fine sands or flours to obtain maximum bulk density combined with minimum permeability has been used to considerable advantage for producing good finish.

With alloy steels, the surface finsh is good and there is a reduced incidence of cold-lap formation which is often prevalent with normal sands. It is generally accepted that cold-lap formation is due to the formation of oxide skins on the molten metal surface and it seems that such films are fluxed away with CO_2 sands.

■ **Collapsibility.** Contrary to the many theoretical predictions which were made on the collapsibility of CO_2 cores when the process was first publicized, there can now be little doubt that the collapsibility is satisfactory for most applications and for metal ranging from light alloys to alloy steels. Various investigators [7, 8, 11, 12] have shown how satisfactorily collapsibility is obtained on all metals with the use of sand additions in certain instances.

To obtain a better understanding of the factors affecting the collapsibility of CO_2 cores, an extensive investigation of the strength of CO_2 sands at varying temperatures has been carried out in the author's laboratories. The curve for the 4 per cent binder addition shows that the strength of the sand varies markedly with temperature; on heating to about 212-392 F, there is a marked increase in strength leading to compressive strengths of the order of 1200 psi.

If the core is heated to about 212 F for only very short periods of time, there is initially a decrease in strength probably due to loss of water from the silica gel, but this is soon superseded by the considerable strength increase. Further heating above 392 F leads to a steady loss in strength and the sand is completely collapsible by about 1022-1112 F and remains so until heated to about 1560 F when the strength gradually begins to climb due to the partial sintering of the binder. As will be explained later, this increase in strength above 1560 F can be markedly reduced or even eliminated by making certain additions to the sand.

Book molds are also made by CO_2. They are clamped between fixed partitions on the foundry floor or upon mobile racks.

Stainless steel castings made by CO_2 are typical. With all alloy steels there is a reduced incidence of cold-laps.

Reduction in binder percentage is most effective in assisting collapsibility but, below about 3 per cent binder content, the cores became friable and would not be generally acceptable for foundry usage. However, even a reduction of a half or one per cent of binder is most effective when good collapsibility is required. Similarly, reduction in the degree of ramming of the core favors improved collapsibility but naturally results in a reduction in the quality of casting finish.

As with surface finish, the addition of carbonaceous material has been found most effective in aiding collapsibility with copper-base alloys and iron; these additions primarily influence the strength curve above 1560 F where sintering of sand and binder occurs and consequently are of little value for light alloy work. Coal dust, pelletted pitch, graphite, asphalt and woodflour have all been employed satisfactorily although there is still the objection to woodflour and, to a lesser extent, to coal dust that they encourage rapid air drying of the mix and core friability.

Methods of Gas Application

Considerable efforts have been made to streamline the application of gas and already much progress has been made. The desirable features of any gassing technique are:

1. To introduce the gas into the sand in the minimum of time.
2. To introduce the gas into all parts of the sand so that they are equally and effectively hardened.
3. To have the minimum consumption of gas.
4. To have the minimum amount of manual work.
5. To have no restriction on mold- or core-making production.

■ **Supplies of carbon dioxide.** Carbon dioxide is available in Great Britain in three main forms: from cylinders of gas, generally of 28-lb size, from liquefiers of 50 to 100-lb capacity into which blocks of solid carbon dioxide may be inserted, and from low-pressure static tanks of several tons capacity which are filled from mobile tankers with liquid gas.

Valves for both cylinders and liquefiers did cause some difficulties initially as they tended to freeze up which restricted and even prevented any flow of gas. This freezing up is due to the absorption of heat as the liquid carbon dioxide in the cylinder vaporizes and as the gas expands on passage from the

high pressure in the cylinder or liquefier, about 700 psi, to the application pressure of approximately 20 psi. However, this difficulty has now been successfully overcome and many suitable valves are now on the market. These are usually either of the so-called double reduction type whereby the gas is reduced to an intermediate pressure of 200 to 250 psi before application, or valves actually incorporating a heating element to counteract the cooling.

■ **Production of molds.** When molds are hardened with the pattern in position, due attention must be given to the pattern equipment as the rigidity of the sand makes stripping more difficult than with green sand. The ease of stripping both molds and cores can be considerably assisted if the following precautions are taken:

a) Any undercuts or dents in the box should be filled with plastic wood or some similar material.

b) The box should be rapped prior to gassing, in the same manner as with normal molding materials. This technique normally eliminates difficulties with stripping unless the pattern has a very deep draw or very little taper. Alternatively, the pattern can be partially stripped while green so as to break any undercuts and then returned to its original position for hardening.

c) Normal paints and varnishes on pattern equipment are of no assistance to stripping and can quite frequently be troublesome due to the softening of the paint by the alkaline binder; lacquers based upon nitrocellulose are fairly trouble-free, but Talbot recommends using one coat of ordinary varnish and finds this most satisfactory. Alternatively, rubbing the surface of the pattern with graphite has been used to considerable advantage.

A recent development due to Parramore[12] which should have a very wide application is the use of wooden patterns and core boxes sprayed with metal using a simple wire-pistol gun. He has sprayed patterns with both aluminum and copper to a thickness of about 0.010 in. and has found that these coatings adhere better if an initial spray of about 0.003 in. of zinc is applied. Naturally these sprayed layers have to be rubbed down with emery prior to use but the quality of pattern obtained is exceptionally good.

1. Hardening by tubes. For initial experiments with the process, the majority of foundries adopt the most elementary method of hardening by introducing the gas into the sand by means of tubes. The passage of gas down the tubes leads initially to rapid hardening in the region of the tube openings, and further hardening occurs as the gas flows outwards through the sand eventually escaping into the atmosphere.

Using this technique, with introduction of the gas at about 20 psi and with an application time of about 15 to 30 seconds, a volume of sand of radius about three to four inches around the tube is effectively hardened. Passage of gas for any longer period of time is unlikely to increase substantially the volume of hardened sand and also increases the possibility of overgassing the sand leading to mold friability.

Apart from these technical considerations, excessive gassing times simply increase the rate of loss of gas to the atmosphere. Similar comments can be applied to the gas pressure employed and the general optimum pressure for efficient and economic hardening has been found to be about 20 psi. However, in certain cases, such as with very fine sands or with some mechanized methods of gas application that are described later, it has been found advantageous to use a higher gas pressure up to about 60 psi; this certainly reduces the time required for effective hardening but reduces the tolerance on gassing times so that overgassing may be more prevalent.

The hardening of molds and also cores by means of 1/4-inch diameter tubes inserted into the sand at four- to six-inch spacings has been practiced quite extensively on a production scale. The main disadvantages of the method are that (a) it is wasteful on carbon dioxide. (b) it is time consuming unless manifold gassing tubes are employed and even then it is not as rapid as other methods, and (c) it tends to cause uneven gassing, particularly as air-pockets are often formed in re-entrant portions of the pattern resulting in ineffective hardening.

However, the tube method is used with marked success, particularly for the production of large molds and cores since the time of gassing in such cases is comparatively unimportant. In a semi-mechanized method that is used on a production scale, a heavily tapered molding box is placed over two metal half patterns; the sand is dumped in from an overhead hopper, jolted and then strickled off. A flat metal plate, preferably having a rubber seal at its edge, and containing a series of tubes connected to a carbon dioxide source is suspended above the molding box; the tubes are spaced at about four-inch intervals and they follow the contour of the pattern.

The plate is lowered so that the tubes are imbedded in the sand and the plate is flush with the strickled surface. Application of carbon dioxide for about 12 to 15 seconds is sufficient for hardening and the two half molds are then tipped out by manual inversion of the box. The total time for the production of these two molds is between 50 and 70 seconds. Of incidental interest, is the technique of clamping a series of these book molds together which leads to a very considerable saving in both molding boxes and floor space.

2. Hardening with hollow patterns. It was appreciated at a quite early stage that it would be preferable if gassing could take place at the sand-pattern interface; this would overcome the principal objection to the tube method where the gas, finding the path of least resistance to the atmosphere often

bypasses pockets of sand, and should also enable increased mechanization of gas application and economies in gas consumption.

Where large number of molds are required, it is economic to make hollow metal patterns and space core-box vents at suitable positions over the working surface. Introduction of the gas into the hollow pattern then hardens the mold surface and gassing times of about 15 seconds are usually sufficient.

Alternatively, a much more simple technique is to adapt a wooden pattern by drilling approximately 1/4-inch holes vertically down through the pattern, filling the holes on the pattern surface with core-box vents and fixing a gas chamber on to the base of the pattern. Such a chamber may be readily constructed by fixing about 1/2 x 1-inch square wooden battens to the bottom of the pattern along with a base board of metal or wood. This chamber should be sealed with rubber strip or other sealing medium so as to prevent gas leakage.

With such a technique, it is very easy to produce shell type molds but naturally of greater thickness than is the case with resin-bonded shells. Such molds can be backed up with green sand of low moisture content.

3. Hardening after stripping green. This technique is perhaps the most versatile method of mold production as it can be adapted immediately to existing pattern equipment, and can also be most economical in gas consumption. CO_2 binders have been developed that impart a moderate green strength to the sand, 3 to 4 psi being typical figures. In addition, these binders have a high sag resistance probably due to the rapid production of a hardened skin on the sand surface. Such binders enable the mold to be stripped green and this is essential with poor quality patterns or those with little taper and a deep draw.

After the pattern has been stripped green, a variety of simple techniques may be employed for hardening the mold. For example, the mold cavity may be covered with a hood or board and gas injected on to it.

4. Evacuation technique. Due to the difficulty with the tube technique of gassing all parts of a mold readily, it was considered by ourselves and also several foundrymen, that it might be possible to reduce the air pressure in a mold or core by evacuation and then harden rapidly and uniformly by application of carbon dioxide. Although this technique might appear a little complex, a prototype piece of equipment has been developed that is functioning satisfactorily for the production of small book molds.

Essentially, the half mold is stripped green and turned out on to a perforated plate which is then transferred on to a wire grid. A metal cover is brought down over the mold so as to form a vacuum chamber. This chamber is connected to a large reservoir which is continually evacuated so that, by opening a valve, the pressure in the vacuum chamber can be instantaneously reduced to a low value. The chamber is then sealed from the vacuum reservoir and connected to a carbon-dioxide reservoir. Hardening is extremely rapid and very uniform and leads to the production of higher strengths than are obtained with other gassing methods.

5. CO_2 shell molds. Similar to the D-process, a CO_2 sand is blown into a cavity forming a shell over the pattern plate. This shell may be hardened by such methods as the simultaneous introduction of gas into the sand-air stream as it enters the mold (see later) or by using a hollow pattern.

■ **Production of cores.** As with molds, the main reason for soft or friable cores resulting from any gassing technique is the channelling of gas in certain specific directions so that pockets of sand do not come into contact with carbon dioxide. This is particularly true with split core boxes where there is a badly fitting parting line or with core-boxes designed for use on core blowers where the venting requirements for satisfactory blowing are often diametrically opposed to those required for an efficient flow of gas through the core. Consequently, consideration must be given to the design of the box so that, with the gassing technique employed, gas channelling does not occur.

1. Tubes and covers. The tube method, as for molds, has been employed quite widely for core production but has frequently given variable and unsatisfactory results. This is particularly true where there are closed ends or re-entrants in the box so that pockets are formed from which the air is only very slowly displaced by carbon dioxide.

Thus, in the production of a simple cylindrical core with a side barrel in a closed-end split box, the introduction of gas by a cylindrical tube down the center of the core for as long as 3 to 4 minutes resulted in serious overgassing of some parts, but the side barrel and nose of the core were still comparatively green.

By cutting vents through the box to the nose and to the side barrel, a clear path for gas through all parts of the core was established and it was decided to apply the gas by means of a rubber gasket, fixed over the print face. Using this technique, the hardening time on this core was reduced to 20 seconds. Also, cores that previously had to be made in two halves can now frequently be made in one piece.

2. Hollow core production. Certain cores, such as cylinder blocks, clutch housings, and gear boxes in the automobile industry, are particularly suitable for production as hollow cores since they have a comparatively large print area-weight ratio.

A typical technique is as follows: a plug of metal defining the hollow portion of the core is attached to the blow plate of a vertical core blower. The dimensions of the simple shape plug are such that there is a half-inch annular space between the plug and the inside of the box and the blow holes in the

blow plate naturally correspond with this space. On blowing, this plug defines the wall thickness of the hollow core as half-inch which was found by practical tests to be satisfactory for strength, ease of handling and resisting premature breakdown during casting.

The following figures serve to illustrate the great economic advantages of the method: Core A: Solid oil core—19.1 lb; hollow CO_2 core 12.9 lb. Core B: Solid oil core —44 lb; hollow oil core 29 lb, which is made in two halves and then joined; hollow CO_2 core 9 lb.

3. Gassing chamber. Although this method has very great appeal, very little production use has been made of it so far. Essentially, the method consists of inserting green CO_2 cores into a chamber through which a stream of carbon dioxide flows. With large cores, the gassing times will probably be considerably in excess of those of other methods and there may be danger of overgassing the core surface. However, for small cores, gassing times are approximately the same as those with other methods.

4. Combined blowing and gassing. Various techniques have been developed whereby carbon dioxide is applied to a core immediately after it has been blown. Another method used on a cartridge-type blower incorporates a gassing cup so that the core may be gassed, using a pressure of about 40 to 60 psi, while the cartridge is being filled with sand for the next core.

However, the ideal is represented by the blowing of a core so that carbon dioxide is applied simultaneously with the admission of sand into the corebox. The method is based on the use of a hollow orifice blowplate which is shaped in the form of a venturi. Assuming that the air pressure used in the core blower is about 100 psi, carbon dioxide is injected into the blow plate at a pressure of about 70 to 80 psi and, on blowing, carbon dioxide is drawn into the sand air stream but does not penetrate into the sand reservoir or container in the blower due to the pressure differential. Naturally, this development will require considerably more experimental work but it will eventually constitute a very satisfactory production method.

There can be little doubt that the techniques employed for introducing the gas into the compacted sand will be the field of greatest development.

▪ **Gas consumption.** It is difficult to give a general estimate of the quantity of gas required for treating a given weight of sand as this naturally varies with the gassing technique employed. The quantity of gas actually absorbed by a correctly gassed core, with say a 4 per cent binder addition, is between 0.25 and 0.3 per cent of the weight of sand treated. These figures have not been achieved in practice, but the author knows of one foundry that has achieved a figure of 0.7 per cent, based upon the weight of sand mixed and the weight of gas purchased. On the very high side and using wasteful gassing techniques, figures have reached 5 per cent but the majority of foundries in this country using the process on a production scale are probably using somewhere between one and two per cent of gas.

▪ **Sand reclamation.** Since the major portion of the binder material is water soluble, it was considered in the early stages of the process that reclamation of used sand by a simple washing process should be a production possibility. Preliminary trials on a laboratory scale showed that all of the residual binder material is removed by boiling water and 80 to 85 per cent by cold water treatment.

A pilot plant treatment of four tons of CO_2 sand that had been employed for steel casting production was carried out in a "log washing" plant. The log washer is based upon improvised equipment employed by gold miners for removing gold dust from sand and clay and consists essentially of a helical bladed shaft mounted parallel to the base of a concrete-lined trough which is inclined at an angle of 1 to 12 to the horizontal. Four rows of blades are welded to the shaft at an angle of 70 degrees and it is driven at a rate of 10 to 14 rpm with an hourly through-put of about 1.5 to 2.0 tons on this experimental plant. Water is supplied from a spray pipe fitted longitudinally above the trough and the water level is controlled by a weir.

The used CO_2 sand was initially fed through a jaw crusher and was charged into the lower end of the trough by a conveyor belt. The sand is driven up the trough by the rotating shaft and, after being exposed to the water spray and a grinding action, it is discharged at the upper end. The sand on discharge contains about 10 per cent of water.

The total sodium oxide content of the sand was of the same order as the theoretical concentration obtained by a 4 per cent addition of the binder. Of the water soluble alkali present nearly 80 per cent was removed by the log washer. An even higher efficiency could have been obtained by reducing the distance between the blades and the trough so that small lumps of sand were completely broken up and thoroughly washed.

The physical properties of the washed and dried sand when bonded with the normal addition of binder were found to compare very favorably with new sand.

References

1. Syssoev, S. I.: *Litinoe Prozvoditro*, 1952, no. 1, p. 5.
2. Schportenko, Z. I.: *Litinoe Prozvoditro*, 1953, no. 8, p. 17-18.
3. Szekeres, J.: Kohazoti Lapok, *Ontode*, 1953, vol. 4, no. 3, pp. 49-56.
4. Schumacher, W.: *Giesserei*, 1953, vol. 40, pp. 678-681.
5. Brunn, F.: *Metallurgie and Giessereitechnik*, 1954, vol. 4, pp. 113-116.
6. Atterton, D. V.: *Foundry Trade Journal*, May 5th and 12th, 1955.
7. Talbot, A.: *Foundry Trade Journal*, May 26th, 1955.
8. Schumacher, W.: *Giesserei*, November 24th, 1955.
9. Saubermann, W.: *Giesserei Praxis*, vol. 73, no. 2, pp. 29-32 and no. 3, pp. 49-51, 1955.
10. Hoar, T. P. and Atterton, D. V.: *Journal of the Iron & Steel Institute*, vol. 166, p. 1, 1950.
11. Rees, I.: Lecture to the West Wales branch of the Institute of British Foundrymen, 1955.
12. Parramore, G. E.: Lecture to the Newcastle branch of the Institute of British Foundrymen, 1955.

Now They're Making CO_2 Shells

Team diaphragm molding, and CO_2 process and contour shells can be made faster and with less sand

THOMAS E. BARLOW / *Sales manager, Eastern Clay Products Dept., International Minerals & Chemicals Corp.*

Contour shells bonded with sodium silicate and carbon dioxide are being made with standard molding equipment of the diaphragm type. The shell uses less sand and can be gassed faster than a traditional mold or core.

Using the same equipment, CO_2 process sand can be used for full facing or for spot facing of green sand molds.

To use the principle efficiently in the foundry, we first replace the ordinary pattern stool with a universal gas-stool. This is either a hollow box with holes to let the gas out or a labyrinth or maze design which will connect with any pattern plate used. The pattern plate is vented with standard core box vents. The underside of the pattern plate may be routed out to connect the vents with the gas chamber. The CO_2 is passed up through the sand from the plate.

The process is much simpler than trying to gas the surface of the mold and expecting the CO_2 to find its way out through the vents. Furthermore, this technique adapts itself to production because the CO_2 valve may be mounted on the machine. After squeezing, the molder hits the CO_2 valve before he strips the mold. In a few seconds, he starts the pin lift and picks off a completely cured mold.

▪ **Contour Shell.** In the contour shell method, the entire mold is made of CO_2 sand. Tight flasks have been used thus far because we were after precision in this process. The flasks are made as shallow as possible. After the high pressure diaphragm squeeze, a shell ranging from 1/2 to 1-1/2 in. in thickness is left to be gassed. After gassing the cured mold is stripped, clamped, and poured.

This process applies to the foundry specializing in such molds and particularly one capable of scrubbing and reclaiming the sand from the shakeout. No green sand or backing is used. Normal flasks and equipment are used throughout.

▪ **Full Facing.** In many cases, the foundry will wish to use a minimum of CO_2 sand or will wish to incorporate the process on selected castings in their regular green sand molding line. In this case, they riddle a thin layer of CO_2 facing over the pattern and then fill the mold with green sand. The gassing is very fast because of the thin shell. After gassing, the mold is stripped, clamped, and poured.

At the shakeout, the cured shell has either disintegrated (at the pattern face) or goes across the shakeout as a core butt. In either case, soda ash pickup is at a minimum. The CO_2 shell and the green sand backing are actually knit together so that the shell does not fall out before pouring because the two sands are squeezed before gassing.

▪ **Spot Facing.** One of the most interesting possibilities is the use of CO_2 sand for spot facing to eliminate a ramup or set core. There are a large number of castings which are essentially green sand jobs, but which could be improved if cured areas or cores could be set at low cost. For example, a cylinder head might be improved by a cured CO_2 facing on the combustion chambers. Again, an air cooled cylinder could be green sand except for the fins. Or we may wish to stop an erosion problem near the ingate.

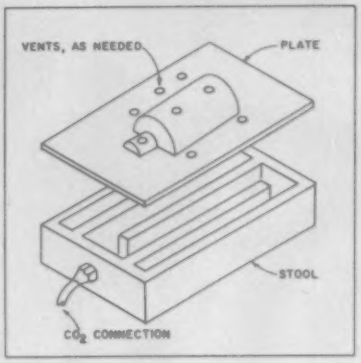
The pattern is mounted on the usual gas stool with a vent or vents located only at the spots to be faced. A handful of CO_2 sand is placed where desired and the rest of the sand is regular backing or system sand. The diaphragm molding method prevents the "spot" from shifting and also provides the squeeze pressure needed for density. After pouring, the "spot" comes across the shakeout as a core butt.

▪ **Results.** Except when spot facing is used solely to stop an erosion or scabbing condition, we have worked with rather fine sands for maximum finish. We found it possible to produce any part (or the entirety) of a casting with "super" finish and unusual casting tolerances. We retained all of the desirable effects of the CO_2-cured mold from the standpoint of dimensional stability, scabbing resistance, and speed of curing. Because we were working with much finer sands than normally used for a blown core, we developed peel and finish equal to the finest obtainable in any other casting technique, including high pressure green sand molding with fine sands.

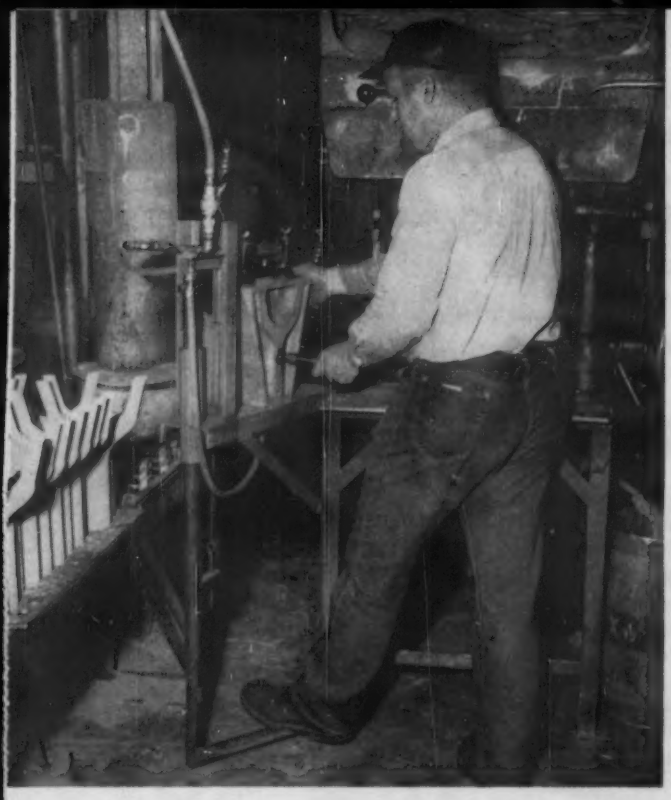
Although we were using a shell of cured sand, we were able to handle the mold in a perfectly normal fashion. Because the CO_2 process facing and the normal green sand were actually molded together before introducing the CO_2 gas, there is no tendency for the two materials to separate or part.

The shell facing should be kept thin for minimum gassing time. Incidentally, passing of CO_2 through the green sand portion of the mold has no effect on the properties of the mold. Only the special CO_2 facing sand hardens during gassing.

Up to now, we have worked with gray iron, aluminum, and bronze. Others will be studied in the future.



Slight modification permits gassing through plate to make diaphragm molded CO_2 shells.



How a Midwestern Foundry Makes CO_2 Cores

They make a lot of 'em but don't claim that the process is more economical, yet

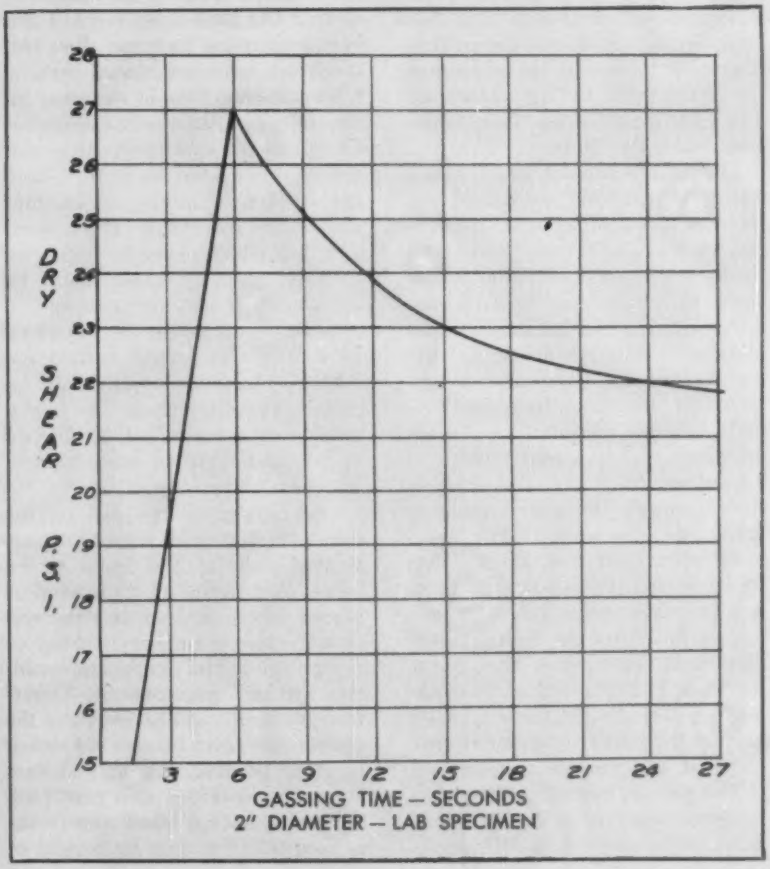
FRANK M. SCAGGS / *General Core Room Foreman*
Oklahoma Steel Castings Co., Inc., Tulsa, Okla.

This universal fixture gasses cores for blast nozzles through the connection at the bottom and through the two rubber cups at the top.

■ In early 1955 Oklahoma Steel Castings Co. was using approximately 70 per cent green sand cores, the remainder being dry bond cores. Although green sand was economical and produced excellent casting quality, it was felt that handling and breakage costs were excessive. We decided to try the CO_2 process to reduce these costs.

Another goal was reduction in overall cost of producing cores by reduction of man hours, reduction of oven equipment, and reduction of indirect labor costs at the paste-up table. The baked cores were producing satisfactory castings, but it was felt that transportation and equipment costs could be cut substantially. Another result hoped for was better dimensional tolerances.

Today our company is producing 8½ tons of CO_2 cores a day, or approximately 60 per cent of production. Our wet sand reclamation system effectively removes sodium silicate residues from the sand and no problem has been encountered there. No difficulties have been encountered in blowing or ramming CO_2 cores. The rammability of CO_2 mixtures, in fact is superior to the



traditional mixtures used in the past.

First tests with CO_2 were on a very small scale, with one bottle of carbon dioxide gas and sodium silicate purchased from a local chemical firm. First cores looked good and produced good castings with only one undesirable result—it was almost impossible to get the cores out of the castings.

To compensate for poor collapsibility and shakeout, organic and carbonaceous materials were added to the sodium silicate mix. This improved the situation but not to a consistent degree that allowed production.

A commercially prepared sodium silicate binder was tried and the desired collapsibility and shakeout were obtained.

CO_2 core production was begun on three jobs in which driers could be eliminated. These were 2-way blast nozzles with 5/16-in. metal sections which must take air pressure testing at 100 psi. As a result of better dimensional accuracy in the CO_2 cores, shop scrap on these jobs was reduced by 4 per cent. No hindered contraction cracks were encountered.

Direct time study by the standards department indicated an overall savings of 15 per cent due to use of CO_2 cores on these jobs. Other savings, such as elimination of driers, were not considered.

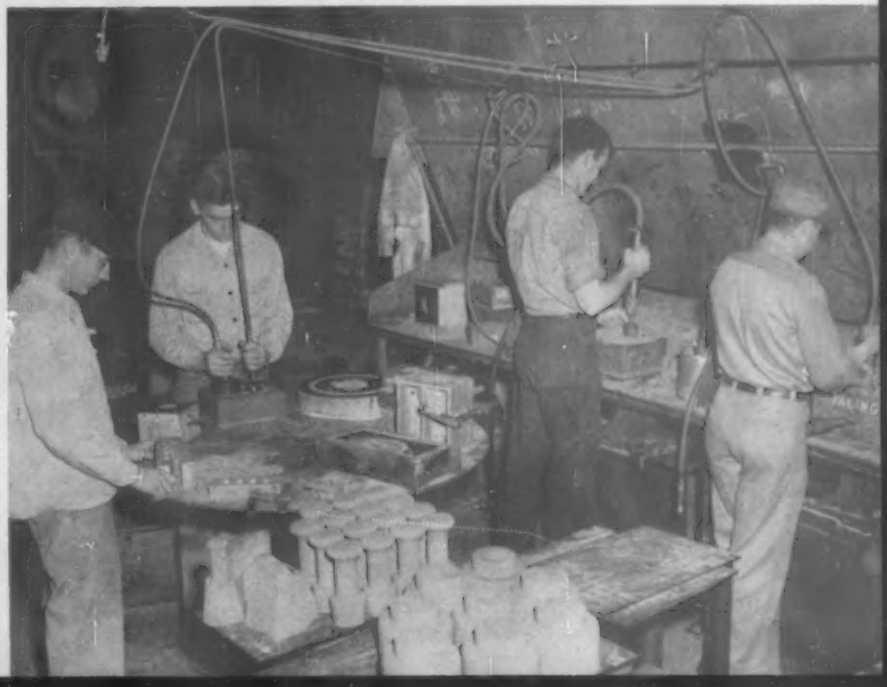
After the nozzle castings, other jobs were tried and new problems appeared—hot deformation and breakage due to low dry strength at room temperature.

We believe that the problem of deformation can be solved by addition of carbonaceous materials, by pocket facing, or overall facing with zircon sand in the correct sodium silicate mixture. It is tentatively concluded that low dry strength was due to clay in the sand in excess of ½ per cent.

Special equipment for the new process consists of two banks of CO_2 bottles, one of 60 and the other 120. Current Tulsa price for CO_2 gas is 4¢ per pound delivered. Present practice requires 1/8 lb

This core is being gassed through back of box using a fixture with four moveable rubber cups which permit universal use of fixture.

Turn-table gassing device is heart of this experimental production line. Two men are making bench cores, third is gassing cores on turn-table, and the fourth removes cores and reclamps the boxes.



THE CO_2 PROCESS

Five-spoke truck wheel cores are gassed with this fixture. Drag half core is at left of operator using gassing fixture and core box.

of CO_2 costing 4 mills per pound of sodium silicate sand. We are confident that use of more accurate gassing times and pressures will enable us to reduce this.

Other equipment for the CO_2 process includes the special gassing devices illustrated and a turntable which permits efficient gassing of cores by indirect labor.

The core mixture generally used is:

Silica Sand, 55 GFN	200 lb
Silica Sand, 100 GFN	100 lb
Sodium Silicate Binder	15 lb
Cereal	2 lb
Iron Oxide	2 lb

This mixture is prepared at a cost of 73c per 100 lb; our conventional green sand mixture costs 54c per 100.

After a year of experience with the CO_2 process we are enthusiastic about its possibilities. We do not contend that the new process is more economical than the conventional techniques. But it is certain that modifications of the process and invention of automatic gassing devices and other equipment expected to be available soon will affect the final cost figures. This foundry has not reached the highest level of efficiency obtainable with the new process, but it is felt that when that level is approached, water glass will pay off.

Three holes in the OD of this sheave core box admit gas from rubber tube clamped over holes. Screens keep sand out of the box.

JAMES R. ALLAN
Allan Industries, Inc.
Melbourne, Florida

WHAT TO LOOK FOR IN A PLANT SITE

Real estate deals can be tricky for relocating or expanding industry

We in industry are suddenly waking up to the fact that we have not been as critical in selecting foundry and plant sites as we should have been. We have been much too prone to take what has been offered instead of insisting upon what we needed. Certainly the majority of cities, counties, chambers of commerce, zoning and planning boards, etc., have not been fully informed about industry's requirements. And here again the blame is partly ours for not having made known what we must have to become satisfied residents of the community.

Many of us have had the experience of buying a beautiful site in the center of a large cornfield, so-to-speak, with no residences or other kinds of activity in the immediate area—only to wake up a few years later to find that we were hemmed in by residential areas. Many industries, after locating in open country, have been put to great expense trying to meet the complaints of nearby residents.

We believe it is possible to avoid this and to obtain the kind of long-range industrial site planning that will provide a maximum amount of protection to the public and reasonable freedom of action and operation for industry.

▪ **Zoning.** The first thing an industrialist wants to know is, what are the zoning laws affecting the location he is looking at? If he is wise and has an eye to the future he will insist that he be located in a large area set aside for industrial development in which, by law, the public will not be allowed to build private homes, nor will even small, unimportant stores and commercial establishments be permitted. The whole area should be surrounded by natural barriers or buffers, such as rivers, lakes, railroad yards, and/or parkways, so that the public will not be extensively affected by noise and vibration created by operations such as in heavy forge shops, etc.

Air pollution is also something that must be reckoned with today, which again makes it absolutely necessary that an industrial establishment be removed some distance from private dwellings. This adds another reason for buffer areas between public and industrial areas.

As long as there is human and industrial activity there always will be a certain amount of effluents such as dust, fumes, and vapors disbursed from stacks, chimneys, and other types of operations within the foundry or factory, even with a reasonable degree of control equipment.

The area must be served with arterial highways for the free movement of employees into and out of the plant. Such highways should be available for the heaviest of trucking and service equipment. These arterial highways should not be carried through residential neighborhoods because industrial plants must operate around the clock and there will be vehicular traffic moving at all times—which is objectionable in residential areas.

The city and county authorities, together with zoning boards, planning commissions, and any other public authorities involved, must work in harmony towards the development of these industrial sites.

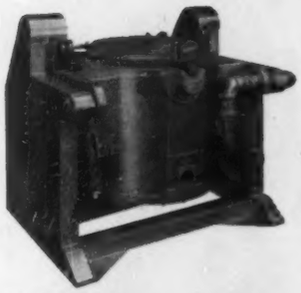
This factor of location and isolation from the public is probably the most important one that we in industry are looking at today when considering a new site.

▪ **Freedom from floods.** The industrialist must know through facts and records that the plant site he is considering is above any flood stage. An industrialist should think twice before considering buying a piece of land, however desirable otherwise, behind a dike erected for the control of flood waters.

▪ **Meteorological factors.** There is much concern today about air pollution—for which industry and commerce is pretty generally blamed. Those of us in industry find it is impossible not to release a certain amount of impurities to the air. The complaints are very likely to arise in areas repeatedly subject to temperature inversion—a meteorological phenomenon.

No amount of control or the finest of equipment will eliminate all difficulties in such areas; hence the prospective industrialist should check with the weather bureau and discuss his problems. If temperature inversions are a factor he should cross the locality off the list.

▪ **Transportation facilities.** We have mentioned that the plant area

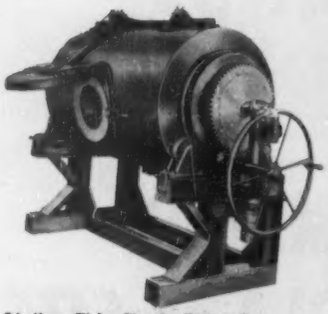


Lindberg-Fisher type MNP nose-pour tilting crucible furnace. Pouring lip is located in the axis of tilting providing a constant pouring arc regardless of degree of furnace tilt. Capacities up to #800 crucible with brass, up to #1000 crucible with aluminum. Oil or gas fired. Described in Bulletin 57-A.

Lindberg-Fisher Electric Resistance Melting and Holding Furnace equipped with heavy duty resistance elements which give uniform distribution of heat, insuring long element and pot life. Capacities 250 to #1000 crucible.

For Non-Ferrous Metals
A complete line of

LINDBERG FISHER



Lindberg-Fisher Simplex Rotary Open-Flame Furnace. Capacities to 2400 lbs. aluminum. 6000 lbs. brass. Oil or gas fired. Described in Bulletin 29-A.

MELTING AND HOLDING FURNACES

For Melting Aluminum • brass • yellow brass bronze • copper • copper nickel alloys • lead magnesium • nickel • tin • zinc.

Because Lindberg-Fisher builds *all* kinds of melting equipment... gas... oil... electric... induction, and Carbon arc... L-F engineers are able to recommend, without prejudice, the proper type of furnace for your particular melting requirements.

Lindberg-Fisher type BB1 Hand-Tilt Crucible Furnace. Tilting mechanism consists of a hand wheel, driven through machined worm gear and pinion reducing gears. Capacities 50 to #400 crucible. Oil or gas fired. Described in Bulletin 400.

Lindberg-Fisher type SF stationary crucible furnace features rapid melting and is recommended for general foundry casting work. Capacities 30 to #400 crucible. Oil or gas fired. Described in Bulletin 301.

Melting specialists for 25 years
Sales and service offices in principal cities

LINDBERG FISHER **MELTING FURNACES**

A Division of Lindberg Engineering Company, 7440 West Hubbard Street • Chicago 12 • Illinois

CIRCLE NO. 181, PAGE 19-20

must be adequately served by arterial highways through non-residential areas. In addition, railroad facilities may be necessary and we in industry requiring rail facilities, always prefer to have at least two competing railroads serve the premises.

We always weigh heavily the ability of the railroad serving the property to interchange with other roads in all radial directions. Locations in a switching district are very important.

We are also interested in the ability of the railroad to make a number of switches throughout 24 hours of the day, which means that switching equipment must be available at all times in the area.

Railroad operations in a community also bring up air pollution problems.

If it is a large operation, it may be advisable to consider the availability of water navigation. If so the industry must own property on the shoreline so that it can be unrestricted in developing wharves, roadways, and approaches.

Probably water navigation is going to play an increasingly large part in the transportation of much of our product in the future because water freight may be one of the last controllable elements of cost reduction in effecting economies for manufacturing enterprises.

■ **Water supply.** The supply of water is one for the county and/or municipality or private water company franchised to do business in the area to develop for the industry.

We do not like the idea of providing our own supply of water. This is a rather dangerous procedure because if water pollution should occur the implication of damage suits is tremendous. Industry is always safer in purchasing its water from an accredited source of supply.

It is not just enough that there be a reasonable supply of potable water for human use and consumption. There must also be adequate water main capacity and a maintained water pressure of 60 lbs. or more. Otherwise industries will be forced to erect costly elevated water tanks for serving sprinkler systems. If the main capacity is not sufficient, the industrialist is put to

the further cost of installing water reservoir tanks connected to his fire pump system.

▪ **Sanitary and storm sewer provision.** The availability of sanitary and storm sewers is an important item in the selection of a plant site. Plants of any great area, with impervious roof surfaces, roadways, storage yards, etc., present tremendous storm water disposal problems. There should be ditches, creeks, rivers, or other natural run-off topographical features, or county and/or city storm sewers into which to discharge storm water.

Here again industry gets itself into trouble many times because of alleged stream pollution.

Industry does not like to put in its own sanitary sewer disposal system. This is an item of expense that we feel should and must be borne by the county and/or municipality and should be a service covered by taxes paid by the industry to the community.

▪ **Electric power supply.** Industry today is a tremendous and increasing user of electric power.

We prefer that power be delivered to our incoming substations at not less than 13,200 volts, 60 cycles. If delivered to the property line at a higher voltage, the utility company should provide a sub-station to reduce the voltage to 13.2 KV. It is becoming customary practice in our modern plants to distribute 13.2 KV throughout the plants through air-cooled network transformers. A power supply of less voltage is expensive to install.

We are also interested in power factor types of rates because we feel that this is most equitable to an industrial consumer who knows his power problems. With proper engineering, he is in a position to develop a high power factor which should reflect in some discount on his purchased energy.

Larger industrial plants are not satisfied with electrical energy served from one source of supply. We feel that we have the right to demand that for loads of 1000 KW or greater the industrial customer be served from two sources of supply from two independent feeders from independent substations so that in case of failure of one line the other will automatically pick up the load. This will prevent seri-

CIRCLE NO. 182, PAGE 19-20

TO HIT PAR GO AROUND WATER HOLE!

(or how control keep score *low*!)

CHIEF KEOKUK:
"My golf ball like turtle, always head for water."
PRINCESS WENATCHEE:
"Little Chief use brains . . . go around water hole."
CHIEF KEOKUK JR.
"Control makes golf game good."

Around the 18 . . . or in processing iron and steel, control plays an important role. Many foundries and steel plants control costs and quality with Keokuk Silvery Pig Iron . . . the superior form of silicon introduction. Pig for pig, car for car, its uniformity never varies. Handle it by magnet . . . charge it by weight (or count the piglets for equal accuracy). Leading aluminum producers specify Keokuk Silicon Metal for uniform high purity. When you think of silicon think of Keokuk.

KEOKUK ELECTRO-METALS COMPANY KEOKUK, IOWA
Wenatchee Division, Wenatchee, Washington

SALES AGENT: MILLER AND COMPANY
332 S. Michigan Avenue, Chicago 4, Illinois
3504 Carew Tower, Cincinnati 2, Ohio
8230 Forsyth Blvd., St. Louis 24, Missouri

Keokuk Silvery Pig Iron is available in 60 and 30 pound pigs and 12½ pound piglets . . . in regular analysis or alloyed with other elements to match your requirements.

CIRCLE NO. 183, PAGE 19-20

ous shutdowns and outages.

Electric energy must be realistically priced because electric power is a very important element in the cost of production.

Power companies should begin to forget a lot of restrictions they imposed a few years ago on possibilities of line surges due to electric furnace operation. We feel that the capacity of the service furnished by the utility company should be sufficiently great to absorb the so-called shocks and bumps.

▪ **Industrial gas.** Many types of manufacture require a plentiful supply of industrial gas, where there are forging, heat-treating, foundry operations, and/or other heat processes involved. Many gas companies are to be severely criticized because they have let industry down by taking on a seasonal domestic, house-heating load which has seriously affected the availability of gas to industry during the critical winter months. We are much more favorable to a location where the gas company realizes that industry can give them a fairly uniform load throughout the year and not just one on a seasonal basis.

Many industries where there used to be plentiful supply of gas for heating operations, have had to move their operations elsewhere or resort to the installation of standby fuels. These standby installations are extremely expensive and so is the standby fuel.

▪ **Availability of workers.** It is quite necessary that there be people in the general area available for employment. A survey should be made by the industry's own personnel department to determine whether the manufacturing establishment can be properly staffed and manned. We figure roughly that one in five of the population in an area is available for work.

People travel 5 to 15 miles to their jobs and 30 miles is not at all unusual in many industrial areas today. With industry demanding a certain amount of isolation, we expect people to have to travel a little distance to their places of employment.

▪ **Character of the land.** Another important element is the topography of the land and the nature

of the soil conditions. If the land requires levelling off it may add too much to the cost per acre.

Good underground soil conditions should prevail in order to support the building footings and the normal floor loads superimposed on the floors. In the case of heavy equipment such as required in foundries, forge shops, etc., exceptionally good soil conditions for considerable distance down into the ground are necessary if costs are to be kept down and spread footings or pilings do not become involved.

▪ **Price of land.** A great deal can be said about the price of land. Many will argue that when a building is going to cost anywhere from $5 to $10 per sq ft the price of land is not too important. On the other hand, the price of land must be realistic. When land values get in the neighborhood of $2500 per acre or higher that means that people are too close to the area and consideration of the site should be abandoned.

We believe there are ample available foundry sites at $1000 or less per acre, preferably outside of city limits.

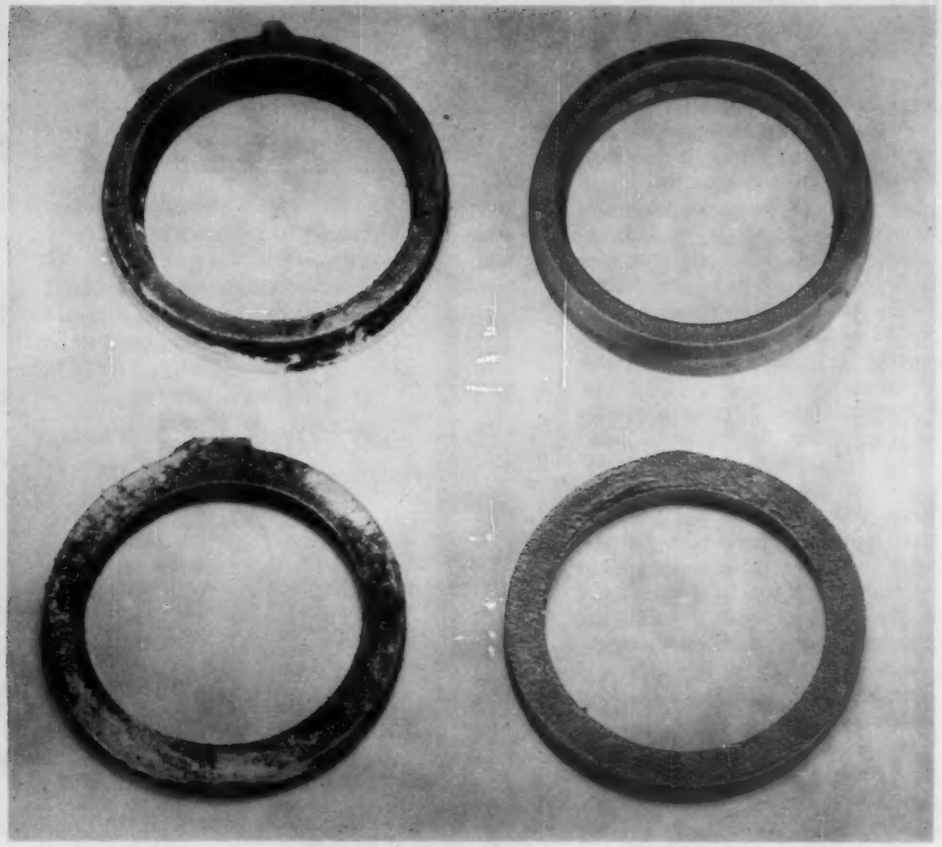
When the price of land gets too high industry curtails the size of plant areas. Usually this results in not having sufficient parking space or areas to expand.

▪ **General observations.** We believe the time has come when there must be a full and frank consideration of all the factors—human and physical—affected by industrial plant locations. We believe new plant location calls for much closer cooperation between county and municipal authorities, planning commissions, zoning boards, and possibly some new concepts of law regarding the rights of property owners. They should not be in conflict with the legitimate needs of commerce and industry which is also making a substantial contribution to the economic and social welfare of the community.

We believe that the local association of commerce must be the agency to bring about this closer cooperation between the various authorities because of its understanding of industrial and commercial problems.

Condensed from a paper presented before the American Industrial Development Council.

SAMMY INGOT
CHECKS THE SPECS FOR GOVERNMENT JOBS
BILL—THERE'S NO MARGIN FOR ERROR IN THIS GOVERNMENT JOB. HAVE YOU CHECKED EVERYTHING?
EVERYTHING BOB, THE MEN KNOW HOW TO CAST AND I'VE GOTTEN SAMUEL GREENFIELD CO. TO SUPPLY THE INGOT.
LABORATORY
THAT'S REALLY PLAYING IT SAFE BOB—FOR GREENFIELD INGOT IS YOUR BEST BET. WE HAVE ALL FEDERAL SPECIFIED ALLOYS. ALL ARE CHEMICALLY PURE AND TESTED IN THIS LAB.
BY CHECKING ALL MATERIALS SPECTOGRAPHICALLY ON THE NEWEST AND MOST EXACTING SCIENTIFIC DEVICES YOU ARE ASSURED THAT YOUR GREENFIELD INGOT WILL MEET THE MOST EXACTING FEDERAL SPECIFICATIONS
WELL—THERE GOES ANOTHER CONTRIBUTION OF OURS TO THE ARMED MIGHT OF OUR COUNTRY—AND SAMMY—YOU CAN TAKE A BOW FOR GIVING US FEDERAL SPECIFIED INGOT ON TIME, AND IN THE QUANTITY WE NEEDED.
"OUR INGOTS MAKE BETTER CASTINGS"
SAMUEL GREENFIELD ALUMINUM ALLOYS
• Chemically Pure
• Rigidly Supervised and Tested
• Certified Chemical Analysis Furnished
FREE FOUNDRY ENGINEERING CONSULTATION SERVICE
Over 120 years combined experience is yours at no obligation. Write or call . . .
SAMUEL GREENFIELD CO., INC.
HUmboldt 4050
31 Stone St. Buffalo 12, N. Y.
CIRCLE NO. 184, PAGE 19-20



Forty-five minutes cleans daily production with the efficiency indicated in before-and-after photo (right) of sand-cast brass rings.

COURTESY OF WHEELABRATOR CORPORATION

HOW A NON-FERROUS JOB-SHOP CLEANS CASTINGS

Charles O. Hiler & Son, Inc., Walkerton, Ind., is a small 21-man jobbing foundry, producing brass, bronze, and aluminum. Both sand and shell molded work are poured—20 tons of brass per month and three tons of aluminum.

Most of this work consists of small castings, so automatic cleaning equipment is used to reduce handling and speed up the cleaning. Cleaning is done by airless abrasive blasting in a two-cubic-foot load unit. Because of the non-ferrous production, steel grit was chosen for the blasting abrasive. Its hardness not only provides lustre and sales appeal, but its metallurgical structure gives a longer life than other abrasives of similar hardness and cleaning speed. Measured consumption of the steel grit is therefore only about 3.5 pounds per operating hour.

Cleaning had been done by both dry and wet tumbling mills. However, these had small capacity and were relatively slow. One tumbling mill was run all day long every day, with cleaning time of six minutes per load. The other was run occasionally, seven to eight minutes per batch of 150 pounds. The combination of automatic blast cleaning and cast steel grit now permits the shop to do its daily cleaning and be free of it in from 30 to 45 minutes' time. The blast cleaner requires only half the attention formerly needed from the operator. As before, the operator does grinding while the cleaning machine operates.

In addition to these factors, automatic abrasive blasting has been found to materially improve quality control. It permits closer and more exacting inspection of the castings. After a given batch of moldings is shaken out and cleaned to virgin metal, molding practice can be checked immediately by visual inspection of the clean castings. This makes it possible to eliminate causes of molding defects before a large number of parts are cast in the run. Scrap loss for the shop has been kept to low limits this way.

With shell mold castings of course, a very fine finish is desired. The shop gives them two blast cleanings. The first is a 1¼-to-2-minute descaling blast after shakeout and de-gating, prior to snag grinding. The second is a 2½-to-3-minute finishing blast right after snag grinding, to blend grinding lines and produce a uniform matte finish with sales appeal.

With sand castings, only one blast cleaning is needed; it's given, after shakeout and sawing off the gate. Blast time is three minutes for brass and 1½ minutes for aluminum.

Technical Committees Chart Course for '57

Focal point of technical activities of the American Foundrymen's Society moved to the LaSalle Hotel, Chicago, on June 4 when the society opened its 1956 Committee Week. Eleven technical committees, the AFS Technical Council, and the Research Committee of the AFS Board of Directors held meetings.

Primarily, these groups represent the planning and administrative functions of the society's technical programs and it was during this week that the course of technical work for the 1956-57 year was charted.

The Technical Council, meeting under chairman F. B. Rote and vice-chairman Frank Shipley, sounded a keynote for the week's activity when it resolved that "the Board of Directors of AFS receive the full support of the Technical Council in its plan to schedule Castings Exhibits . . . to supplement the technical activities of the Society." Following this lead, the divisions and general interest committees, whose officers form the Technical Council in the technical program, began to make plans for programs planned to fit into the Engineered Castings Show (see page 27 for the complete story on this new development.)

Other important actions of the Technical Council included the revival of the Die Casting Committee of the Light Metals Division and the activation of the Intra-Industry Coordination Committee of the Brass and Bronze Division which will attempt to bring AFS, the trade associations, and the industry together in a cooperative program of product development.

C. E. Nelson presided at the Board Research Committee meeting which approved a budget alloting $48,000 to AFS-sponsored research projects for the next fiscal year. The committee also recorded its sentiments that the research budget should be increased each year if technical committees continue to suggest such projects that justify AFS backing. The group also unanimously commended all technical committees now doing research work for "the continuing effort and valuable assistance . . . in furthering the objectives of AFS for the benefit of the foundry industry."

Formation of a Research Advisory Council was announced during Technical Committee Week. This new group is intended to coordinate at the working level the activities of all AFS committees carrying on active research programs. Membership of the new group will consist of the chairman of the research committee of each AFS technical division and the chairman of all general interest committees conducting or supervising AFS research activities.

Other organizational changes announced during the week included the formation of the Cupola Advisory Committee from the former Cupola Research Committee. The new group will no longer do any research but will conduct a literature survey. Name of the Refractories Committee has been changed to the Refractories Manual Committee and will work at completing this publication.

Technical committees that held sessions during the week were: Steel Division—Executive and Program & Papers; Pattern Division—Executive and Program & Papers; Sand Division—Executive and Program & Papers; Brass & Bronze Division—Executive Committee; Gray Iron Division—Executive and Program & Papers; Educational Division—Executive and Program & Papers.

Technical council, left to right, Wm. W. Maloney, C. E. Westover, V. E. Zang, W. R. Jaeschke, R. F. Dalton, W. H. Ruten, J. E. Foster, H. J. Heine, Chairman F. B. Rote, Vice Chairman F. W. Shipley, H. W. Dietert, E. A. Welander, H. Bornstein, O. C. Bueg, E. C. Zirzow, O. J. Myers, C. G. Fuller, E. V. Blackmun, D. L. LaVelle, H. C. Ahl, and R. J. Keeley.

AFS Board Research Commitee members, at June meeting, from left to right, Harry W. Dietert, O. Jay Myers, Hans J. Heine, Chairman C. E. Nelson, H. C. Erskine, Wm. W. Maloney and Lewis H. Durdin.

Exhibitors committee, discussed plans for coming year, left to right, Wm. W. Maloney, AFS; W. N. Davis, AFS; John M. Kane, American Filter Co.; C. V. Nass, Beardsley & Piper Div., Pettibone Mulliken Corp.; V. F. Stine, Pangborn Co.; W. D. Stewart, Aluminum Co. of America; G. E. Seavoy, Whiting Corp.; L. L. Andrus, Wheelabrator Co.; Harry W. Dietert, Harry W. Dietert Co.; F. W. Shipley, Caterpillar Tractor Co.

ALUMINUM FOUNDRY gets high strength

Heat treat eliminated by using new alloy, normal technique, standard equipment

Recently, our foundry successfully completed a highly specialized job consisting of three giant-size 340-lb aluminum alloy castings for an important Philadelphia packaging machinery manufacturer. These castings—the table and two supporting rings for a cardboard carton printing machine—measured 69 in. in diameter and were among the largest ever sand-cast in a new high-strength alloy of the aluminum-zinc-magnesium type.

Previous attempts had been made to cast these parts out of a common aluminum alloy that, quite naturally considering the size of the rings, tended to twist and warp under required heat treatment. This resulted in rejects that delayed production and boosted manufacturing costs. The special alloy was specified for our operation because it requires no such distortion-producing heat treatment. It was, in fact, developed especially to satisfy the need for an aluminum alloy that would age at room temperature, and which would produce mechanical properties equivalent or superior to those normally obtained only by solution treating, quenching, and artificial aging.

For this reason, the alloy (which conforms to ASTM Specification B-179-50T alloy ZC81A-B) is extremely valuable for castings too large or too intricate to undergo heat treatment without distortion.

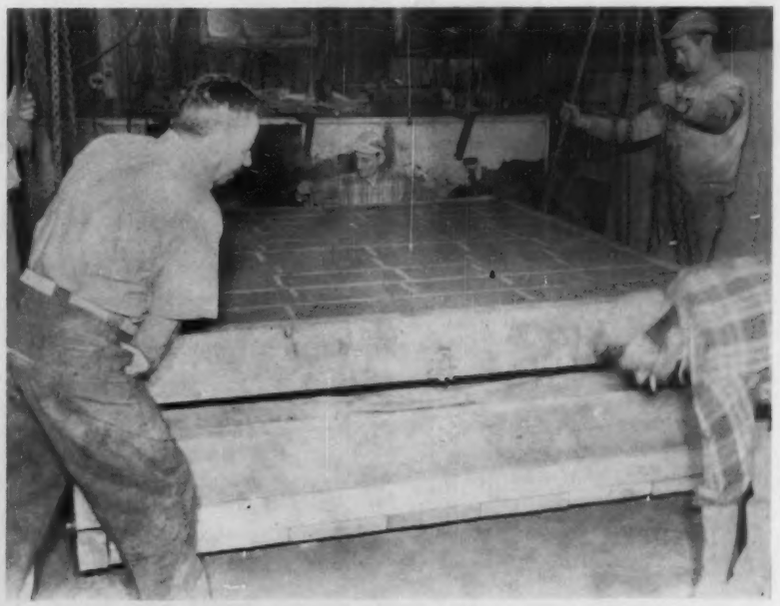
Because the printing machine ring castings were so large—the biggest was 69 in. in diameter, 9 in. thick, 5 in. across the face, and weighed 340 lb—we had to stagger the production schedule to enable each part to be poured, finished, and shipped to the customer before the next part was started. During these operations, which gave us our first experience with the alloy in large castings, we came across many of its interesting and important properties.

First, we found that no unusual precautions, techniques, or facilities are required. Although it does have a somewhat narrower solidification range than most ordinary alloys, its slightly higher shrinkage may be readily compensated for by the use of somewhat heavier gates and risers, the specifications of which are governed by the design of the patterns and cores in the casting. If adequate gates and risers are employed, pressure-tight parts can be cast successfully without any difficulty.

Pouring temperatures are generally about the same as for other aluminum alloys; for these castings we poured at 1300 F. Carefully prepared fine, New York green sand was used. Core practice is also the same as for other aluminum alloys, but in other cases where relatively large cores are surrounded by thin walls it is advisable to use cores which are not too hard, and collapsible.

The alloy is not sensitive to the composition variations normally experienced in good foundry practice, with the exception of silicon contamination. Here we might stress that silicon pick-up from other alu-

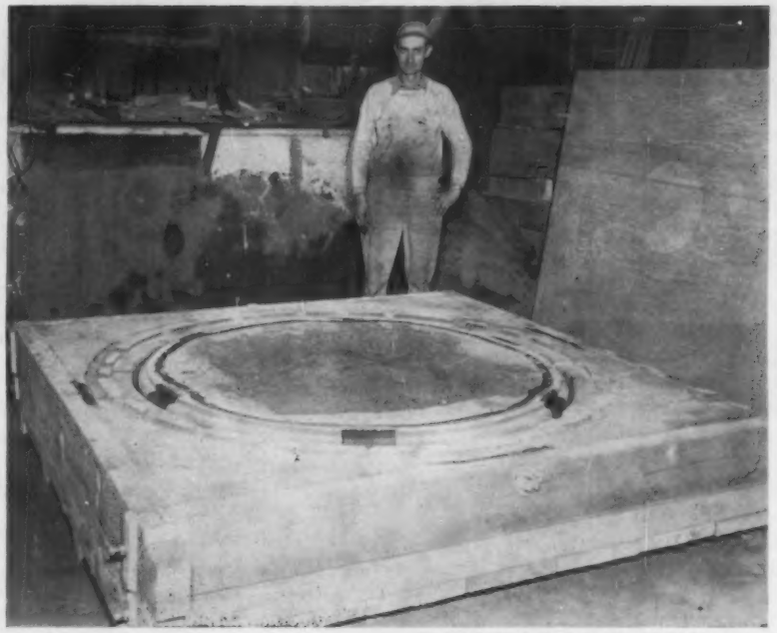
The whole crew is tense when the mold is poured. Temperature is about the same as for pouring other aluminum alloys, about 1300 F.



Cope is carefully lowered and locked to the drag. Slightly heavier gates and risers are used with this alloy to compensate for shrinkage.

without heat treatment

ARTHUR VAN NEWKIRK
Rolle Aluminum Co.
Philadelphia



PHOTOS COURTESY OF FEDERATED METALS.

Drag for this job shows details in design of this largest casting attempted to date, a 69 in. diam ring for a carton printing machine.

minum alloys be avoided. Clean crucibles and skimmers should be used and no metal of unknown origin should be permitted to enter a heat. No magnesium additions are required.

As far as dross removal is concerned, a flux may be used but we found that skimming was sufficient in itself.

Significantly, it gives consistently sharp impressions and clean castings. The new alloy holds its dimensions remarkably well. It does not "grow" as do many aluminum alloys that commonly contain copper and silicon as the major additives in the compound. The only precaution we might recommend is to avoid excessive turbulence while pouring.

Our "heat treating" procedure consisted of exposing the castings to room temperature. Since air costs nothing, there is no expense for un-needed heat treating equipment. This reduces cost of production considerably.

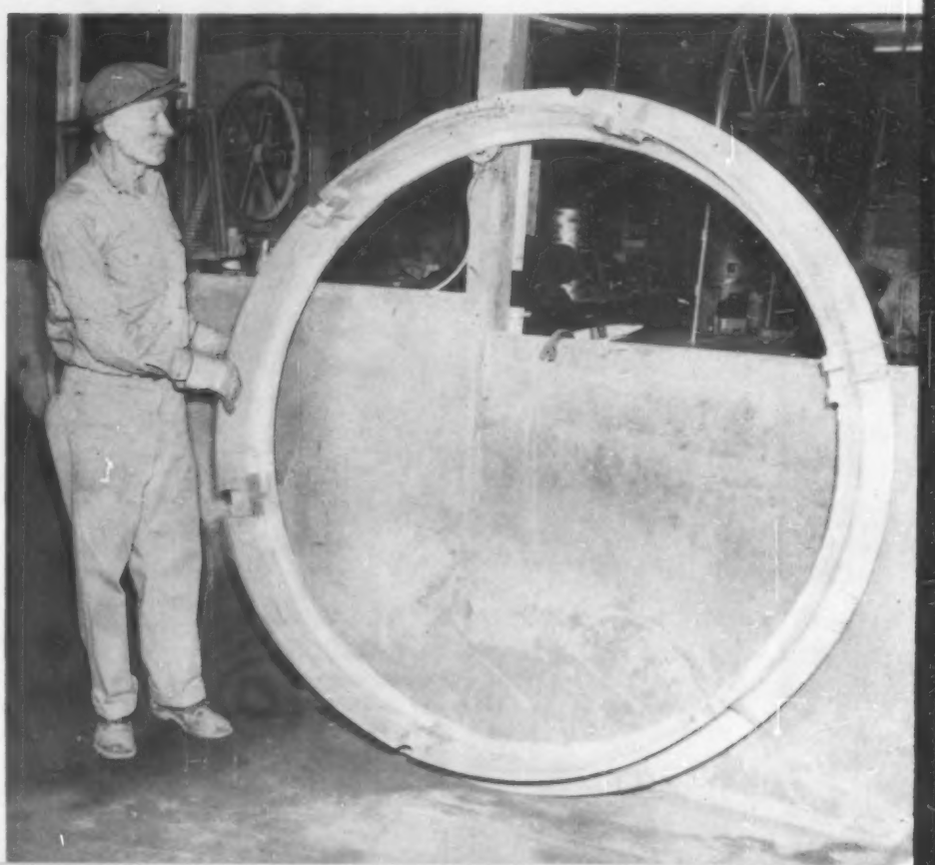
We found that this new alloy reaches full strength after a relatively short time. Natural aging—14 days or longer at room temperature—normally produces a better combination of properties than artificial aging. (The alloy can be artificially aged at 250 F for ten hours if final properties must be developed in the shortest possible time.) After aging the big ring castings for three weeks at room temperature, we tested the metal and found it to have these properties: tensile strength, 35,000 psi; yield strength, 25,000 psi; elongation (2 in.), four per cent; and a Brinell hardness of 72.

The alloy shows excellent ductility, particularly in the early aging state. Consequently, cold working or forming should be done within a day or so after pouring. It has top-notch characteristics for smooth machining and handles much better than the common aluminum-copper alloys. However, if machining operations are performed too soon after casting there may be a tendency toward gumminess. We found that the alloy machines best after a few weeks of hardening.

As far as Rolle Aluminum Co. is concerned, its use has enabled us to turn out castings that are at least as good and frequently better than those produced by artificial aging of common alloys. There is high resistance to impact and shock. The corrosion resistance is equal to that of the aluminum-silicon alloys. And the silvery-white castings take an exceptionally brilliant polish. Because the alloy does not require quenching, internal stresses normally found in high-strength, heat-treated castings are absent.

Thus we have been able to obtain high as-cast properties without heat treatment, and high-yield strengths that permit the metal to be stressed beyond the limits of high-strength non-aging alloys. As a result, we have been able to handle with ease jobs that would normally present thorny production headaches.

Here is the finished casting. Because of the ductility of this self-aging alloy, it is now ready for machining without heat treatment.



AFS CHAPTER OFFICERS

CONFER

formally &

Flanked by the flags that represent the three nations in which AFS chapters are located, President Frank Shipley convenes the meeting.

informally

Some darn good ideas were probably spawned during this informal session that centered on a conversation between President F. W. Shipley and G. R. Rusk, national director. Others are Ken Smith, Central Illinois, and H. K. McAllister and F. W. Menzel of Oregon.

Stimulating the flow of ideas for planning and carrying out successful programs in the chapters of the American Foundrymen's Society was the motivating theme behind the 13th Annual Chapter Officers Conference of the society. Over 115 representatives of the 45 AFS chapters in the United States, Canada, and Mexico were on hand for the sessions at the LaSalle Hotel in Chicago, June 28 and 29.

Conference chairman was AFS President Frank W. Shipley, Caterpillar Tractor Co. He was assisted by AFS Vice-President Harry W. Dietert, Harry W. Dietert Co., and General Manager Wm. W. Maloney.

In opening the two-day session, Shipley stated that, "Good programs mean more members," but warned that AFS is a forum, not a platform, and programs must be selected and supervised with care.

Topics presented by conference delegates as part of the Chapter Officers Conference program included planning chapter technical and educational programs, and, for the first time, development of regional conferences.

Panelists discussing chapter educational programs were: Bill Mc Fatridge, *Chicago;* Harold Henderson, *Northern California;* John Roth, *Twin City;* and Morris Mc Quiggan, *Eastern Canada.*

Members of the panel on developing chapter programs were: Bob Colton, *Metropolitan;* Ken Smith, *Central Illinois;* John O'Meara, *St. Louis;* Fred Kellam, *Ontario;* and Dick Westendorf, *Cincinnati.*

Successful regional conferences were discussed by the following panel drawn from chapters sponsoring these meetings: George Barker, *Wisconsin;* Clyde Armstrong, *New England;* Fred Menzel, *Oregon;* John Drenning *Birmingham;* Alex Barczak, *Northeastern Ohio.*

In introducing the five-man panel to discuss the regional events, President Shipley stated that, "Regional meetings are an important *society* activity," and pointed to the ten 1955-56 regionals which involved a total of 28 industrial and student AFS chapters.

Staff members of AFS discussed the society's technical program, the safety, hygiene and air pollution control program, and MODERN CASTINGS, the official AFS publication.

Vice-President Dietert explained the purpose and importance of the visits by AFS directors to the individual chapter meetings. He stated that these visits come as a part of "democratic government in the society." Dietert also explained the organization of the society into regions headed by regional vice-presidents who are society directors.

After this discussion of directors and vice-presidents, General Manager Maloney opened a discussion of increasing the number of members in the society's ranks. He stated that the three primary reasons for increasing the membership of the society are: to provide the strength in numbers to maintain chapter organizations; to promote the success of individuals by bringing them into the society's activities; and to strengthen the society's ability to influence foundry progress by increasing the number of people that the society can reach.

During the conference special meetings were held to permit individual chapters or groups of chapters to settle such questions as round-robin speakers, chapter territories, and organizing for the 1957 AFS Castings Congress in Cincinnati. These meetings were conducted with the assistance of the following AFS directors who attended the conference: C. C. Drake, R. W. Griswold, Herbert Heaton, A. V. Martens, G. P. Phillips, R. Verne Righter, and G. R. Rusk.

foundry trade news

Colonial Metals Co. . . Columbia, Pa., aluminum ingot producer has installed an electronically controlled conveyor for pouring its molten aluminum. This technique permits production of uniform weight ingots.

Arrow Pattern & Engr. Co. . . placed its new plant at Erie, Pa., in operation on July 1. New building houses wood and metal pattern shop, aluminum green sand foundry, and new shell molding operation. Shell molded castings in aluminum and brass alloys are being produced by company's new division, **Arrow Shell Cast.**

Owen Sound Metal Industries Ltd. . . Foundry at Owen Sound, Ont., has joined Gray Iron Founders' Society.

Almco . . finishing equipment division of Queen Stove Works, Inc., has built a laboratory at Albert Lea, Minn., where firms may determine, without obligation, the most effective deburring and finishing methods for all types of parts.

Aluminum Co. of America . . has purchased a site in Edison Township, N. J., for erection of $1.5 million die casting plant. Plant will replace Alcoa's Garwood, N.J., works.

Frank B. Stallings . . Cleveland industrialist has purchased the machine tool and pedestal grinder lines of Bradford Machine Tool Co. and will move the production to Lansing, Mich.

Carborundum Co. . . will open a multi-million dollar plant for production of grinding wheels at Logan, Ohio, early this fall. Plant will incorporate the latest material handling and processing equipment. Ohio location is part of move to disperse an industry now centered on Niagara Falls, N. Y.

A national industrial exposition to be held at the Artillery Armory in Detroit will feature a "Metals Day"

Carborundum Company: builds to decentralize and to add production.

Almco: builds to establish finishing research and development lab.

carl mayer VERTICAL CORE OVEN

with Patented Heating System

With the heat fan located inside the oven, heat loss is reduced—installation cost is lowered—smoking is eliminated. Recirculating type heating insures close temperature control and uniform baking.

carl mayer RACK TYPE CORE OVEN

Exclusive panel construction and recirculating heating afford better structural strength and maximum heating efficiency, as compared with ovens of other types!

Write for Bulletin 53-CM

THE **carl mayer** CORP.

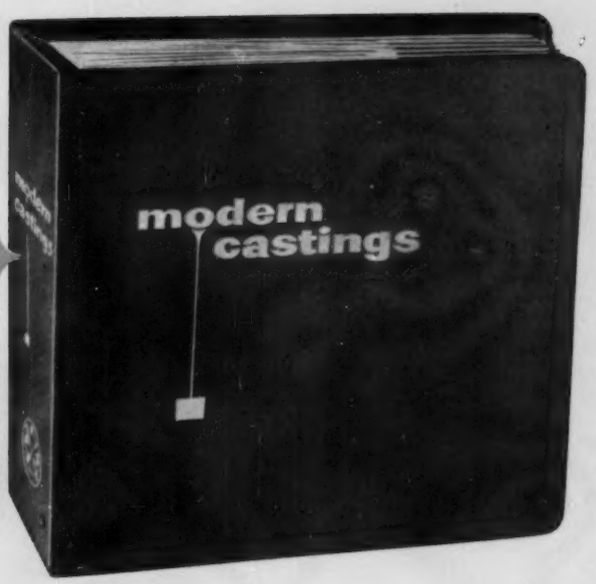
3030 EUCLID AVENUE CLEVELAND 15, OHIO

OTHER PRODUCTS: Core & Mold Ovens • Rod Bakers • Paint and Ceramic Drying Ovens • Special Processing Equipment & Accessories

CIRCLE NO. 185, PAGE 19-20

MODERN CASTINGS BINDER

- FOR YOUR DESK
- FOR YOUR BOOKSHELF
- FOR YOUR CONVENIENCE



A FULL YEAR OF MODERN CASTINGS

Yes! This big, sturdy binder holds a full year of **modern castings** or the old American Foundryman. Rawhide effect maroon cover with gold lettering. Copies are held by individual rods, easy to insert or remove, yet firmly fastened when you want them to be. Binder opens beautifully flat—like the magazine itself. There's no peering into the gutter trying to read what's buried under the stitches.

The **modern castings** binder will look handsome on your desk or bookshelf. Answers your need for a handy, easy-to-use reference file of a full year's magazines. Inexpensive, too—only $2.50 each.

AMERICAN FOUNDRYMEN'S SOCIETY
Golf and Wolf Roads, Des Plaines, Illinois

Please send me_____ of the new modern castings 12-issue binders. I enclose_____ ($2.50 each —includes postage).

NAME_____

COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

on October 25. A management-engineering conference by a panel of manufacturing experts will cover new ideas for industry in the fields of metals and metal products.

Electro Metallurgical Co. . . has announced that higher production costs have made necessary increases in the prices of some chromium alloys and calcium-silicon. Increases average about 6 per cent.

Semet-Solvay . . Allied Chemical & Dye Corp. division will not move its office from 2532 Buhl Building, Detroit 26, Mich., as was previously published in this column.

Smith Steel Foundry Corp. . . Elkhart division of this Grede Foundries subsidiary has joined Gray Iron Founders' Society.

Canadian Westinghouse Co., Ltd. . . plant at Hamilton, Ont., has joined Gray Iron Founders' Society.

General Electric Co. . . has changed the name of the Carboloy Dept. to the **Metallurgical Products Dept.** to reflect the firm's emphasis on metals development and manufacture.

Marion Machine, Foundry & Supply Co. . . foundry at Marion, Ind., has joined Gray Iron Founders' Society.

Allis-Chalmers . . A-C's Industries Group has published an illustrated booklet describing the engineering developments made in the group's plants during the past year.

Electro Refractories & Abrasives Corp. . . has installed a continuous kiln capable of producing silicon carbide crucibles and retorts up to six ft.

Wall Colmonoy Corp. . . has completed new, modern foundry facilities for production of its hard-facing alloys. Plant is at 19345 John R St., Detroit.

Frank Harding Foundry . . New Brighton, Pa., division of Schaefer-Goodnow Foundries, Inc., has joined Gray Iron Founders' Society.

Archer-Daniels-Midland Co. . . has moved its New York office to Room 1600, Transportation Bldg., 225

continued on page 78

Outline of Sand Technology

Condensed from the Sand Technology Short Course prepared by Clyde A. Sanders, American Colloid Co., Chicago, O. Jay Myers, Archer-Daniels-Midland Co., Minneapolis, and Hans J. Heine, AFS Technical Director, Des Plaines, Ill. The Short Course has been presented before AFS chapters and regional conferences; the complete outline with explanatory material and references for further study is available at 50¢ a copy.

This comprehensive study will appear on this page for the next three issues of Modern Castings. *The editors hope that you will find the information as useful as did Lewis H. Durdin, Dixie Bronze Co., Birmingham, Ala., who has already complained that the information is too elementary. He said even he understood it.*

■ The best metallurgical talent cannot offset the crippling effects of poor sand conditions and lack of control over this important raw material. Scientific sand control gives economies in the cleaning room and the machine shop and results in reduced scrap, increased yield, and lower costs. Here is an outline for control.

Components of Molding Sands

1. Fundamentals of Sand. Silica sand is the same as quartz. It is one of the hardest minerals available, most abundant in nature, is resistant to slag attack and abrasion, and is refractory. It is a granular aggregate of the mineral SiO_2.

Sand is a particle size classification which can be defined as grains of mineral matter ranging between 1/12 to 1/500 in. in diameter. The fine material is naturally or artificially produced by the disintegration or crushing of rocks or minerals.

Silica sand is easily mined in deposits universally located and is available in a variety of grain sizes and distrbution. All sand is not silica, but may be olivine (contains no free silica), zircon, or any other refractory material. Molding sand is further divided into bonded or unbonded sand.

2. Natural Compounded Sand

I Advantages of synthetic sand

a) Can be tailor-made for the job.

b) Can operate at about one half the moisture content.

c) High strength is possible with high flowability.

d) Sharp sands are usually available in any locale.

II Disadvantages of Compounded Sand

a) Grain distribution is not always optimum. It may be necessary to blend two or more sands.

b) Moisture control is more critical.

c) Sharp sand may segregate during shipment and unloading.

d) In most cases a cushioning or filler material is required.

e) Synthetic sands dry out faster, therefore, the handling and storage is more of a problem.

III. Advantages of natural sand

a) Inherent resistance to expansion defects; have their own cushioning material.

b) Inherently better grain distribution.

c) Can be worked over a very wide moisture range—4% to 8% usually.

d) Can be readily packed.

e) Does not segregate during shipment.

f) Can be used where very little control is available.

3. Sand Preparation

The purpose of mulling is to develop strength by obtaining a continuous, smooth coat of bond around each sand grain. Five to six minutes on slow, heavy mullers will develop approximately 80 to 90% of the green strength. High speed mixers can do the work in a shorter time, possibly 1-1/2-3 minutes. Paddle mixers are less efficient than the other types. Consideration should be given to the feasability of adding clay and water as a slurry. (A good rule of thumb is to add hydrophyllic materials first, then the hydrophobic ingredients).

Always use weight, not volume, for measuring additions at the mixer.

Important hints to minimize clay balls are the following:

a) Work sand as dry as possible, under existing conditions.

b) Keep the clay as low as possible.

c) Keep the fines as low as possible.

d) Reduce riddling and handling to a minimum.

e) Avoid long mulling and heavy additions of new sand.

f) Purchase naturally bonded sands without clay balls.

4. Clay Additives. Principal clay minerals used as additives are:

Kaolinite—the chief constituent of fire clays.

Montmorillonite—the chief constituent of bentonite.

Illite—a mineral found in many clays and shales.

All three are used as bonds in compounded molding sands.

I. Fire clay binders

a) Usually contain from 30 to 75% true clay.

b) May vary in refractory value by as much as 700F.

c) Produces properties most closely related to those of a naturally bonded sand.

d) Low in first cost and has high durability.

This sand needs mulling.

foundry facts

Sand / Technological Principles

e) Less sensitive to percentages of clay and moisture.
f) Easier to use when sand grain distribution is not optimum.
g) Exhibits medium values of dry strength.

II. Western (sodium) bentonite
a) About twice as strong as the fire clay bond.
b) Less clay and less moisture is required.
c) Unusually high dry strength and hot strength.
d) Very adaptable for use in steel or large gray iron castings.
e) Develops the least flowability but the best deformation.

III. Southern (calcium) bentonite
a) High in green strength.
b) Lower durability.
c) High flowability.
d) Low dry strength.
e) Combines maximum flowability with high permeability with easy shakeout.

IV. General note. In making an average size gray iron casting clay is burned out to a depth of between 1-1/2 to 2 inches from the mold-metal interface.

5. Water as an Additive. Water is the most important source of trouble. The requirements depend on the grain size of the sand. Too much water means oxidizing conditions, excessive gas evolution, low permeability, high dry strength, low mold hardness, poor flowability, and high hot strength.

Moisture can be a chief cause for many casting defects.

Bentonite-containing mixtures yield the best green strength at low moisture. Water affects every physical property of the molding sand, with the exception of grain fineness, size and shape of the aggregate. Bulking and inundating must be avoided.

6. Carbonaceous Additives. Sea coal (finely ground bituminous coal), pitch (by-product of coke making) and gilsonite (naturally occurring pitch) are important in giving good peel, not primarily finish. Five per cent sea coal in a green sand mixture should give adequate peel.

Pitch does not work satisfactorily in dry sand molding unless the water content of the mixture is high. Pitch is used in amounts up to 4% in dry sand molding.

Gilsonite is a solid, natural pitch or bitumen and furnishes a rich carbonaceous facing additive. It is quite potent and used in quantities between 0.4-0.8% in green sand molding.

Finely ground graphite powder may also be added to molding sand and will give a good casting peel. Ground coke has been used. Fuel oil is often added to gray iron and malleable sands in amounts of 1 pint per 1000 lb of mixture.

I. Seacoal
a) Seacoal is used to prevent sand grains from burning onto the metal and to improve the finish of the casting.
b) Creates a reducing atmosphere at mold-metal interface.
c) Less seacoal is required if castings are permitted to cool completely in the mold.
d) The following factors affect the selection of proper seacoal: weight of casting, surface area of casting, cross sectional area of casting, and grain fineness of sand.
e) Seacoal affects: green strength, permeability, contraction and expansion, deformation and resiliency, and moisture.

II. Pitch
a) By-product of gas producers.
b) Present use limited to fine sands and cores.
c) Usually 1% is used in green sand work, and 2% in dry sand.
d) More moisture is required when pitch is used for dry sand molding.
e) Imparts considerable dry strength in dry sand molding.

7. Cellulose Additives. These are cushioning materials necessary with compounded sands. They burn out at elevated temperatures. Wood flour is the most popular. Cellulose materials, cereal hulls, alfalfa fines and others are sold under various trade names. All are used to improve surface finish and reduce surface defects.

Ferrous foundries generally use 0.5 to 1% cellulose material. It furnishes a reducing atmosphere in the mold, deposits carbon on the mold wall, and lets the metal flow more easily. Collapsibility is aided.

Deformation is enhanced and green cracking of the mold wall is minimized when correct amounts are used. Cellulose additives are partially replacing cereals, when water solubility and skin dry strength are not a factor, because they are cheaper.

Clay shrinks and sand expands when the hot metal strikes the mold wall. In formulated sands containing little clay, the cereal permits expansion of the silica grains and yet prevents the sand grains from spalling.

All cellulose materials increase the amount of temper water required, but scabs, rat tails, buckles and veins are minimized.

8. Fine Inorganic Additives. Silica flour and iron oxide are the most common fines additives. Olivine flour, fly ash and alumina are others. Silica flour is more widely used in steel foundry practice.

I. Silica flour
a) Green, dry, hot, and retained strength are materially increased by silica flour.
b) Sintering, green deformation, hot deformation, density, and expansion are increased by silica flour.
c) Permeability and flowability are lowered.

II. Iron oxide
a) Finds extensive use in core sand.
b) Fluxes with silica to form strong plastic glass at high temperatures.
c) Holds sand grains together after core binder is decomposed.

III. Additives in shell molding
a) Slight improvement in surface finish with 10% silica flour.
b) Substantially improved surface quality conditions in steel castings with 7-1/2 to 10% zircon flour.
c) No significant improvement in surface finish with up to 5% iron oxide additions.

Sand series will continue

Further topics in the series include properties of molding sands and components of core sands.

for the asking

Phenolic resin detailed in Technical Bulletin F-6 is water soluble. It's used for blowing shell molds with conventional equipment and techniques. Bulletin also tells how to use it. *Reichhold Chemicals, Inc.*

CIRCLE NO. 61, PAGE 19-20

Roller chain and sprockets are detailed in 148-page Book 2457. Sections are illustrated, give all data needed to choose the right roller chain for a given job. *Link-Belt Co.*

CIRCLE NO. 62, PAGE 19-20

Molten salt pump handles molten metals equally well. 4-page Bulletin 800 discusses advantages, typical uses, performance data. *Ajax Electric Co.*

CIRCLE NO. 63, PAGE 19-20

Binder specially formulated for large cores gets the full treatment in 8-page Technical Bulletin 1. It's a dark, viscous liquid with excellent storage life. Three pages of charts show

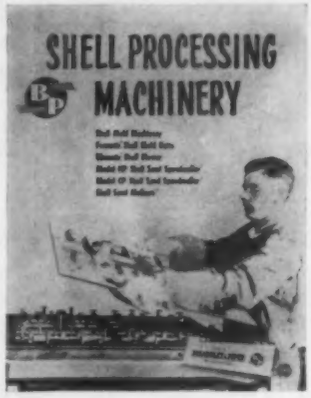
green compression against time under various conditions. *Archer-Daniels-Midland Co., Foundry Products Div.*

CIRCLE NO. 64, PAGE 19-20

Nondestructive testing is discussed in 8-page Form 148-2. Booklet examines testing as a production tool and contains several case histories to illustrate the concepts. *Magnaflux Corp.*

CIRCLE NO. 65, PAGE 19-20

Shell processing equipment is presented in 16-page Bulletin 6000. It gives descriptions, diagrams, specs, photos, engineering data, construction



features, other salient information on molders, blowers, mullers. *Beardsley & Piper Div., Pettibone Mulliken Corp.*

CIRCLE NO. 66, PAGE 19-20

Washes for green sand molds are discussed in 4-page bulletin. Pyrokoat-G wash is for gray iron and nonferrous molds and cores; Pyrokoat-S wash is for steel and malleable molds and cores; and Superkoat wash is recommended for all four. Bulletin tells how to use each, from original mixing to final application. *Delta Oil Products Co.*

CIRCLE NO. 67, PAGE 19-20

Nickel alloy castings are the "heroes" of 16-page case history booklet describing how many destructive service problems can be solved by using special sand and centrifugal castings. "Cast to Outlast" also gives properties, alloys, range of forms, and specs. *International Nickel Co.*

CIRCLE NO. 68, PAGE 19-20

Diaphragm molding machine gives complete, simple, and reproducible results. Hardness is consistent and uniform throughout the mold, and from mold to mold. Twelve-page bulletin "Taccone Diaform Molding Ma-

Once again FOSECO® leads the field... with CO_2 SET for the Carbon Dioxide Process

Much of the basic research and development of the CO_2 process was done in the laboratories of Foundry Services.

The many advances made in foundry and metallurgical fields over the past thirty years have called for the development of new and specialized products. Foseco has helped lead the way in this development, introducing over 150 Foseco products which are used in nearly every country in the world.

Foseco's CO_2 Set process is typical of Foundry Services' advanced, scientific development to help foundrymen.

FOSECO CO_2 SET FOR MAKING MOLDS AND CORES

A process of mixing dry sand with a sodium silicate based binder, molding the sand into shape and then hardening the sand mass with carbon dioxide gas . . .

- Speeds mold and core making
- Eliminates baking
- Gives greater dimensional accuracy
- No distortion
- Absence of obnoxious fumes

. . . and many other advantages lead to considerably greater output for very little capital outlay.

To order your free copy of this booklet telling exactly how to make the best molds and cores . . . with FOSECO CO_2 SET . . . just fill in and return the coupon below.

FOUNDRY SERVICES, INC.
2000 BRUCK STREET COLUMBUS 7, OHIO
In Canada: FOUNDRY SERVICES (CANADA) LTD., 201-7 Alice St., Guelph, Ontario

Send my copy of "FOSECO CO_2 SET for the Carbon Dioxide Process."

Name_____
Company_____
Address_____
City_____ State_____

CIRCLE NO. 186, PAGE 19-20

The accompanying chart is tangible evidence of PROGRESS. It shows that, in nine years' time, FEF has stimulated enough interest among engineering colleges to increase the value of teaching facilities — foundry laboratories — over $1,296,700.

It's up to you . . . foundrymen, foundry equipment manufacturers, foundry suppliers . . . to keep this progress going.

FOUNDRY LABORATORIES – VALUE OF FACILITIES

$1,034,000 1947

$2,446,250 1956

To determine your stakes in this worthwhile effort, write for booklet "Let's Look Ahead".

You'll be glad you did.

Foundry Educational Foundation

1138 TERMINAL TOWER BUILDING • CLEVELAND 13, OHIO

Space Contributed by **modern castings** as another service to the metal casting industry.

CIRCLE NO. 209, PAGE 19-20

chines" tells how and why. *Eastern Clay Products Dept., International Minerals & Chemical Corp.*

CIRCLE NO. 69, PAGE 19-20

Patching gun for cupolas is nicely described and pictured in 4-page "Cupolinor 1500" bulletin. This is a deluxe unit, plenty big for production jobs and quite simple to use. *Eastern Clay Products Dept., International Minerals & Chemical Corp.*

CIRCLE NO. 70, PAGE 19-20

Mold coatings, core coatings, core oils, and other sand conditioners formulated for steel are presented in 8-page illustrated Bulletin 56-2. These products are engineered for foundry requirements, the bulletin reports. *Thiem Products, Inc.*

CIRCLE NO. 71, PAGE 19-20

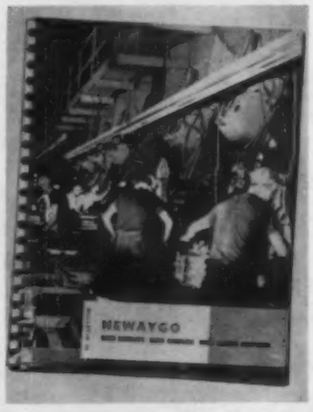
Dust control is the general topic of unfolding brochure. It gives a rough idea of the size and complexity of the subject, and points the way toward getting a successful system. *Pangborn Corp.*

CIRCLE NO. 72, PAGE 19-20

Airless blast cleaning and its use with shell mold castings is the subject of 4-page "Shell Mold Casting Cleaning and Finishing News". Three illustrated case histories are given. *Wheelabrator Corp.*

CIRCLE NO. 73, PAGE 19-20

Foundry equipment bulletin stresses mechanization or automation wherever possible. Units listed include sand handling systems, floor units, mold



handling equipment, flasks, etc. "More Molds With Fewer Motions" contains 32 pages. *Newaygo Engineering Co.*

CIRCLE NO. 74, PAGE 19-20

Furnaces are shown and described in 4-page Bulletin 104. They'll melt nonferrous alloys, and are fired by either

gas or oil. These single burner tilting crucible units come with crucible sizes from 40 to 10,000. *Campbell-Hausfeld Co.*

CIRCLE NO. 75, PAGE 19-20

The works are shot in 50-page Condensed Catalog 564, which pictures and specifies everything Syntron makes. This ranges from vibratory equipment through seals and rectifiers to portable power tools. *Syntron Co.*

CIRCLE NO. 76, PAGE 19-20

Oil-gas burners are detailed in 4-page bulletin. These are pulsation type units with simplified, high-efficiency nozzle mixing and high-pressure air atomizing. Refractory liner acts as catalyst to induce complete full fuel burning under all conditions. *Radiant Products Co.*

CIRCLE NO. 77, PAGE 19-20

Molder described and pictured in 4-page Technical Bulletin JSI-4-56 is a two-station indexing type jolt, squeeze, strip machine which is controlled automatically or semi-automatically. Specs and dimensions are included along with typical installations. *Herman Pneumatic Machine Co.*

CIRCLE NO. 78, PAGE 19-20

Molybdenum alloys which give lighter, smaller cast steel gears are discussed in 4-page pocket size "Moly Steels for Cast Gears". *Climax Molybdenum Co.*

CIRCLE NO. 79, PAGE 19-20

Foundry flasks and accessories are tabulated, specified, and illustrated in giant 60-page Catalog 69. Items include flask bars, steel bushings, bands and upsets, slag buggies, wheelbarrows, etc. *Sterling Wheelbarrow Co.*

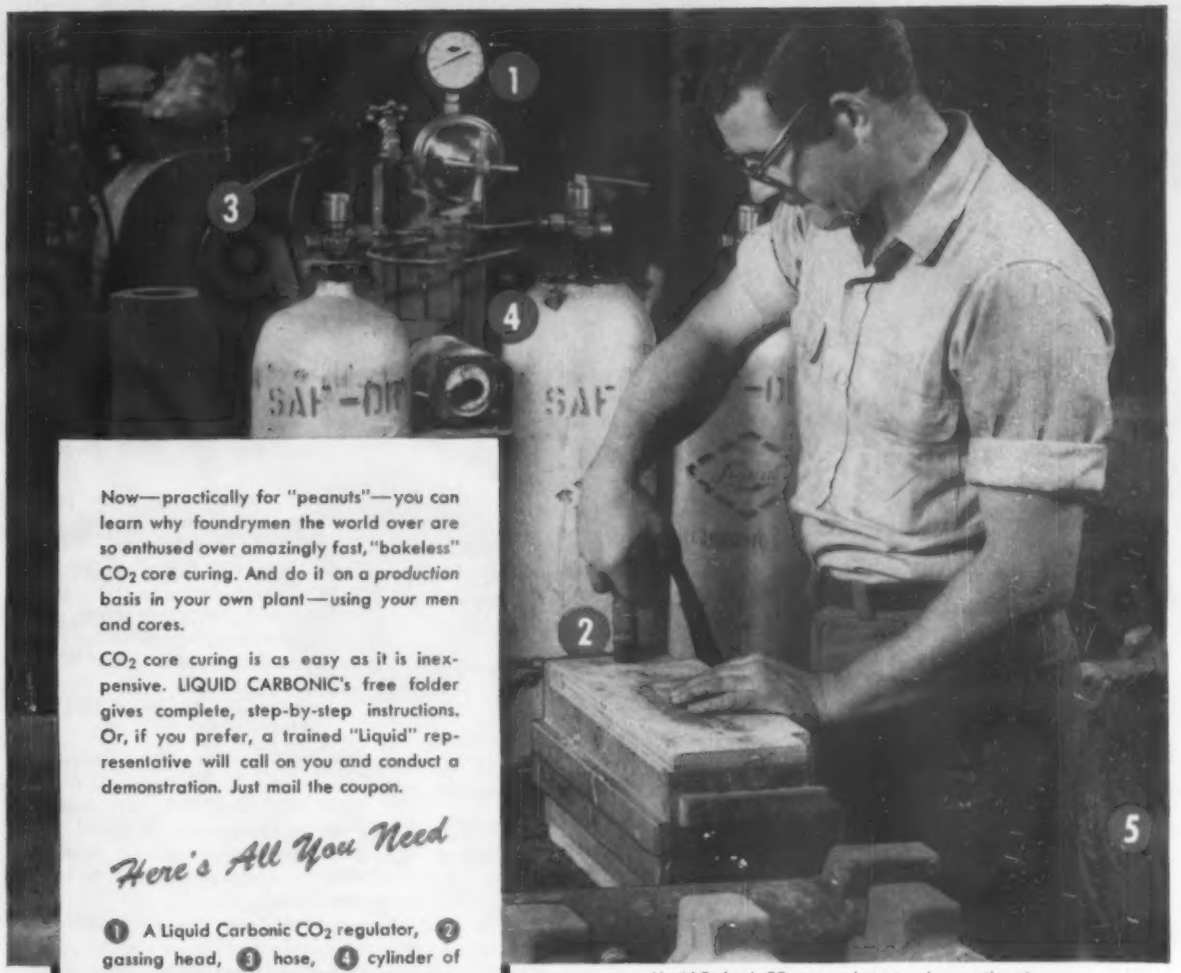
CIRCLE NO. 80, PAGE 19-20

Metallic abrasives are discussed in 18-page, 2-color Catalog 566 in terms of lab facilities, technical data, and types of shot and grit. SAE specs are included, as well as various types of cleaning and peening methods. *Cleveland Metal Abrasive Co.*

CIRCLE NO. 81, PAGE 19-20

Shell molding booklet is written from the viewpoint of a supplier of phenolic resins and molding compounds. The booklet itself is well printed, a really professional job; inside, the information is useful, instructive, and easy to read. Contents cover the process pretty thoroughly: advantages, equipment, materials, operating

a production CO_2 core curing set-up for less than $50.00



Liquid Carbonic CO_2 core curing set-up in operation at Pacific Brass Foundry, San Francisco, California.

Now—practically for "peanuts"—you can learn why foundrymen the world over are so enthused over amazingly fast, "bakeless" CO_2 core curing. And do it on a *production* basis in your own plant—using *your* men and cores.

CO_2 core curing is as easy as it is inexpensive. LIQUID CARBONIC's free folder gives complete, step-by-step instructions. Or, if you prefer, a trained "Liquid" representative will call on you and conduct a demonstration. Just mail the coupon.

Here's All You Need

1 A Liquid Carbonic CO_2 regulator, 2 gassing head, 3 hose, 4 cylinder of Red Diamond CO_2. Total cost, under $40. 5 *Special Binder.* Available from numerous sources at little more than core oil cost. Binder coats sand particles, reacts with CO_2 to harden cores in seconds.

Liquid

World's Largest Producer of CO_2

THE LIQUID CARBONIC CORPORATION

3166 South Kedzie Avenue
Chicago 23, Illinois

FREE INSTRUCTION FOLDER

Gives complete information and step-by-step instructions on CO_2 core curing.

MAIL THIS COUPON TODAY

THE LIQUID CARBONIC CORPORATION
3166 South Kedzie Avenue • Chicago 23, Illinois

☐ Send me your free instruction booklet on CO_2 core curing.
☐ Have your representative call and give me demonstration of CO_2 core curing.

Name_____
Company_____
Address_____
City_____ Zone____ State_____

CIRCLE NO. 195, PAGE 19-20

First with — BETTER METAL ABRASIVES FOR Blast-Cleaning

For 70 years Pittsburgh Crushed Steel Company has developed better metal abrasive through exhaustive research and has maintained its leadership by continuing research and improvement.

A complete line of steel malleable and standard chilled iron shot and grit.

NOW IN 50-LB. Double Burlap BAGS

Sold and Recommended by PANGBORN CORPORATION Hagerstown, Md.

- **Samson Shot and Angular Grit** — The original chilled iron metal abrasives that led to the conversion from sand to metal abrasives for blast cleaning. Still accepted today as the best.
- **Malleabrasive** — The original patented malleablized type of metal abrasive of greater toughness and longer life. Still leads the field.
- **Tru-Steel Shot** — The original super-tough, heat-treated and drawn shot of tool steel quality. Now the pace setter in production of the all-steel type of shot.

Packed in handy 50 pound reinforced burlap bags — easy to handle — speeds unloading of truck and handling within the plant.

PITTSBURGH CRUSHED STEEL CO.

Arsenal Station, Pittsburgh 1, Pa.

Subsidiaries: Globe Steel Abrasive Co., Mansfield, Ohio; Steel Shot Producers, Inc., Butler, Pa.

METAL ABRASIVES FOR EVERY NEED

CIRCLE NO. 188, PAGE 19-20

cycles, and cores. Probably of the most value is the final section, a service guide for trouble shooters. It tells what to do for weak shells, thin or thick shells, peel-back, drop-off, spotty shells, sticking, poor filling, warped shells, cracking, fins and bonding problems, surface imperfections, shrinks, and coated sand problems. All this in 24 pages of compact data! *Plastics Engineering Co.*

CIRCLE NO. 82, PAGE 19-20

Carbon products for cupola furnaces include well zone linings, breast and tap hole constructions, slag dams, slag and iron trough linings. Catalog Sections S-5450 and S-5455 tell all about them. *National Carbon Co.*

CIRCLE NO. 83, PAGE 19-20

Snagging grinders shown and specified in Bulletin C1 are of the infinitely variable speed type. The whole big line incorporates features for safety and increased production. *Foundry Grinder Div., Standard Electrical Tool Co.*

CIRCLE NO. 84, PAGE 19-20

Foundry data contained in pocket-sized booklet called "Useful Information for Foundrymen" concerns cupolas, electric furnaces and transformers, fuels, ladles, melting points, temperatures, weights, other operations. Also contains reference tables and room for working notes. *Whiting Corp.*

CIRCLE NO. 85, PAGE 19-21

Marking crayons give permanent, fade-proof indications on all surfaces —hot, cold, dry, wet, oily, rough, or smooth. They work on metal, glass, plastics, rubber, anything. Four-page selection chart tells which to use on what. *Markal Co.*

CIRCLE NO. 86, PAGE 19-20

Woven wire screens for repair and replacement are discussed in Bulletin 67. Contents include sizes and types of screening available for immediate delivery. Many illustrations. *Simplicity Engineering Co.*

CIRCLE NO. 87, PAGE 19-20

Unit heaters, both horizontal and vertical models, are shown in 34-page Bulletin 700A. Improvements, specifications, and complete performance data is given. *American Air Filter Co.*

CIRCLE NO. 88, PAGE 19-20

Epoxy pattern materials are thoroughly discussed in 16-page Technical Data Bulletin T-24. Contents cover mold construction and preparation, casting process, laminating, match-

METALLURGICAL CHEMISTS

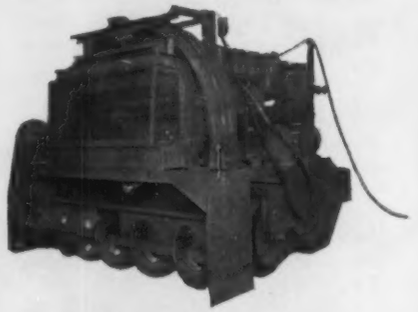
- *Chemical Analysis*
- *Spectrographic and Fluorescent X-Ray*
- *Physical Testing*
- *Metallographers*
- *Foundry and Metallurgical Consulting*

YOUR INQUIRIES ARE INVITED

Charles C. Kawin Company
P. O. Box 2035, Buffalo 5, N.Y.
431 S. Dearborn St. Chicago 5, Ill.

Since 1903

CIRCLE NO. 189, PAGE 19-20



Model B34 Ringlift

Ringlift foundry sand conditioners mix, add water, remove all sand from floor, screen, magnetically separate, aerate and discharge molding sand at rates to one ton per minute. Will cool hottest sands. 36" wide screen-fed magnetic separator assures practically perfect shot iron removal.

Cuts swath to 104" wide, straddles windrows 24" high x 70" wide, but can handle much larger windrows or piles where it is unnecessary to straddle them. Turns in 63" radius, needs only 76" headroom. Most economical machine of this type to buy, to operate, to maintain.

For complete description & specifications write to

STATES ENGINEERING
CORPORATION
922 W. Berry St. Ft. Wayne, Indiana

CIRCLE NO. 190, PAGE 19-20

plates, core blow boxes, special precautions. *Houghton Laboratories, Inc.*
CIRCLE NO. 89, PAGE 19-20

Belt idlers of unique design are shown in Booklet 2-70 (12 pages, printed in 2 colors). Contents cover design and application data for "Limberoller" idlers, which consist of neoprene or rubber discs on a flexible wire rope. *Joy Mfg. Co.*
CIRCLE NO. 90, PAGE 19-20

Magnetic vibrators shown in 6-page, 2-color illustrated Brochure VB-1 have Alnico permanent magnets and AC electromagnets. No separate rectifier needed. *Eriez Mfg. Co.*
CIRCLE NO. 91, PAGE 19-20

Welding steel castings is detailed in 40-page booklet. Contents include welding methods, electrodes, procedures for carbon steel and low-alloy steel castings of many types. Steel Founders Society originally put out this highly useful item. *Tempil Corp.*
CIRCLE NO. 92, PAGE 19-20

Compensation insurance costs can be held down, reports 44-page pamphlet. It explains a four-fold medical and health program: in-plant medical plan, industrial hygiene program, medical advisory service, and rehabilitation program, *Liberty Mutual Insurance Co.*
CIRCLE NO. 93, PAGE 19-20

Centrifugal fans are discussed and specified in two separate bulletins: DS-348B covers backward-inclined blade fans, and DS-348F covers forward-inclined blade fans. They're Class I and II centrifugal units. *Trane Co.*
CIRCLE NO. 94, PAGE 19-20

Valves for air or oil hydraulic service to 200 psi are presented and pictured in 6-page folder, Form BV-1. These are the MV series valves, designed for easy installation and maintenance. *Modernair Corp.*
CIRCLE NO. 95, PAGE 19-20

Sand coating muller and accelerating agent are presented in 4-page folder. Muller coats or blends foundry sand with dry or liquid resin; the accelerator is an efficient solvent and wetting agent. *Shallway Corp.*
CIRCLE NO. 96, PAGE 19-20

Bendable tube called Plica has obvious installation advantages. Cut it with a knife or hacksaw, bend it by hand, fit it to any standard connectors. Three-ply wall is made of almost any desired combination of ferrous

HERE IT IS...

The Unique Foundry Text

PRINCIPLES OF METAL CASTING

PROFESSOR
Wm. H. Rutes
Brooklyn Polytechnic Institute
By far the best textbook adapted to college courses yet produced by metal castings industry. It is the book we have all been waiting for.

CHIEF METALLURGIST
Angelo Dubis
Sterling Foundry Co.
Every metallurgist, designing engineer, and shop library should possess this book. It not only mentions practically everything in the casting process, but gives references to further information on any subject.

FOUNDRY CONSULTANT
Wm. L. Rudin
Elesco Smelting Corp.
A book written for the first time that presents the theoretical and practical aspects of the foundry operation in proper balance and perspective. The foundryman can cover the whole gamut of metal founding principles—all in operating men's language—and arranged for easy reference.

MANAGER RESEARCH & DEVELOPMENT
John A. Rassenfoss
American Steel Foundries
A sound text for a study of the technical aspects of the American foundry industry and an excellent reference manual.

COVERS . . . molding process including the sand casting methods, shell molding, die and permanent mold casting, investment, etc. Mold materials and construction, molding equipment, solidification of metals, gating and feeding of castings, molding sand technology, cleaning of castings, castings design, metallurgical principles associated with melting, composition of casting alloys and their properties, heat treatment, and metallurgical processing characteristics of foundry practices. No processes other than metal casting are considered.

Principles associated with molding processes and materials and solidification of metals are presented in the first eleven chapters; the principles are then interpreted for the specific casting alloys (fourteen chapters). Special metallurgical principles of melting, alloying, heat treating, and metallurgical processing are confined to portions of the latter fourteen chapters.

Prepared by Richard W. Heine and Philip C. Rosenthal of the University of Wisconsin, Madison, Wisconsin.

CASE BOUND

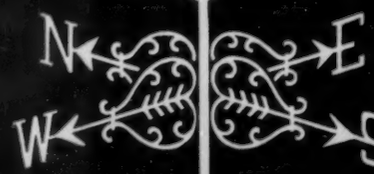
Size 6 x 9, contains 639 pages, over 300 illustrations. Published by McGraw Hill Book Co., Inc., New York, for AFS.

Price $7.50

AMRICAN FOUNDRYMEN'S SOCIETY
Golf and Wolf Roads
Des Plaines, Illinois

Please send _____ **Copies of "Principles of Metal Casting"**
I enclose $ _____ **Please send invoice** _____
Name _____
Company _____
Address _____
City _____ **P. O. Zone** _____ **State** _____

CATALIN UREA AND PHENOLIC Shell and Core Binders



FORDS, NEW JERSEY

CALUMET CITY, ILLINOIS

THOMASVILLE, NORTH CAROLINA

FAST DELIVERIES!

From three strategically located plants . . .
Catalin Service *Speeds* Quality—in Quantity!

Catalin, pioneer producer of an extensive range of urea, phenolic, cresylic, resorcinol, melamine and styrene formulations . . . is proud of its product reputation, and prompt service from all three of its modern processing plants: these as pictured hereon are most desirably located in the East, Midwest and South.

For the foundry industry, Catalin produces a group of fast curing, Urea and Phenolic Resins (liquid and powder) as binders for shell molds and sand cores. Serving both ferrous and nonferrous metal castings, these thermosetting formulations are developed to meet specific foundry requirements.

Catalin field representatives, experienced in the problems of the foundry industry, welcome the opportunity to discuss the superior advantages of Catalin Foundry Resins. Inquiries invited!

Catalin

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE, NEW YORK, N. Y.

branch offices:
CHICAGO, ILL., 221 No. LaSalle Street
GREENSBORO, N. C., 630 Southeastern Bldg.

CIRCLE NO. 191, PAGE 19-20

or non-ferrous metals, fiber, paper, etc. Continuous lengths; high wall strength; watertight. Sizes are 3/8 through 2" ID. Chief uses are electrical conduit, airlines, insulating or protective covers. Bulletin 61 tells all. *Flexaust Co.*

CIRCLE NO. 97, PAGE 19-20

Dust control case histories given in "High Score" folder are brief and strictly to the point; they cover sand handling, cupolas, grinding, other foundry applications. *American Wheelabrator & Equipment Corp.*

CIRCLE NO. 98, PAGE 19-20

Trade fair of international proportions is outlined in a series of booklets and sheets. It will be held in Dusseldorf, Germany, this fall, so there's still plenty of time to get in on what promises to be an excellent production. *German-American Trade Promotion Office.*

CIRCLE NO. 99, PAGE 19-20

Furnaces and ovens in several series of standard and special models heat to 3000 F, reports loose-leaf industrial furnaces catalog. The bulletin is packed full of descriptions, data, performance charts, and specifications. *L&L Manufacturing Co.*

CIRCLE NO. 100, PAGE 19-20

Control valves for pneumatic or hydraulic service are known as B-type valves. Chambers are formed by aluminum spacers held in accurate metal-to-metal end abutment. All parts are in pressure balance. Rated at 600 cpm for continuous operation. Holds to 250 psi. Available in single and double solenoid, also lever and single and double piloted designs. Bulletin 561 gives more details. *C. B. Hunt & Son, Inc.*

CIRCLE NO. 101, PAGE 19-20

Bonding agent called Emeri-Bond sticks Emeri-Crete Flooring to new or old concrete floors. Two-page Bulletin EB-1 describes how it's made and used. *Walter Maguire Co., Inc.*

CIRCLE NO. 102, PAGE 19-20

Sandpaper data is contained in 16-page "Sandpaper—How to Choose It". Booklet also tells how to use it, how it's made, and what goes into it. Simple but useful. *Behr-Manning Div., Norton Co.*

CIRCLE NO. 103, PAGE 19-20

Electrochemical analysis is described in a beautiful full-color brochure showing steps from sample preparation through recording of line spectra

on film and subsequent interpretation. *National Spectrographic Labs, Inc.*
CIRCLE NO. 104, PAGE 19-20

Aluminum castings can be tricky. "Producing Leak-Proof Aluminum Castings", a 4-page reprint, may give the right tip to solve this problem in many foundries. *George Sall Metals Co., Inc.*
CIRCLE NO. 105, PAGE 19-20

Wire rope slings that offer the flexibility of hemp, strength of steel, kink-free construction, and a bright finish are featured in 4-page Folder DH-532A. Many sizes and styles are specified. *Wire Rope Sling Dept., American Chain & Cable Co., Inc.*
CIRCLE NO. 106, PAGE 19-20

Lift truck applications that are out of the ordinary are documented in the Spring issue of "Handling Materials Illustrated". Case histories range from an atomic plant to a zoo to a foundry. *Towmotor Corp.*
CIRCLE NO. 107, PAGE 19-20

Medium duty fire bricks are the topic of 4-page Bulletin 105. One is a dense, tough stiff mud type refractory, the other is a high quality dry press brick. Bulletin tells where and how to use each. *The Ironton Fire Brick Company.*
CIRCLE NO. 108, PAGE 19-20

Molding machine for match plate patterns jolts, rolls, squeezes, draws, and closes. Four-page Folder 25-A contains full specs, description of features, and dimensioned cutaway sketch. *The Osborn Mfg. Co.*
CIRCLE NO. 109, PAGE 19-20

Core oils, high refractory core and mold coatings, and other sand conditioners for gray iron are detailed in 8-page illustrated Bulletin 56-1. Some technical data is included in the descriptions. *Thiem Products, Inc.*
CIRCLE NO. 110, PAGE 19-20

Belt conveyor presented in 4-page Bulletin 103 has 22 separate and standard undercarriages and supports to give it maximum versatility. It comes in lengths to 40', widths to 2'. *New London Engineering Co.*
CIRCLE NO. 111, PAGE 19-20

Industrial floor materials are discussed in 12-page specification and

FOR SALE . . .

MODERN AUTOMATION FOUNDRY
IMMEDIATE POSSESSION

BUILDINGS ..... 95,000 SQ. FT.
LAND ..... 19 ACRES
COMPLETELY EQUIPPED

- **Railroad Track Scale**
- **Cranes**
- **Cupolas**
  Two 100" diameter shell lined to 74"
  21 tons each per hour
- **Conveyor systems (overhead and underground)**
- **Underground sand handling**
- **Unlimited rail service**
- **Excellent separate office building**

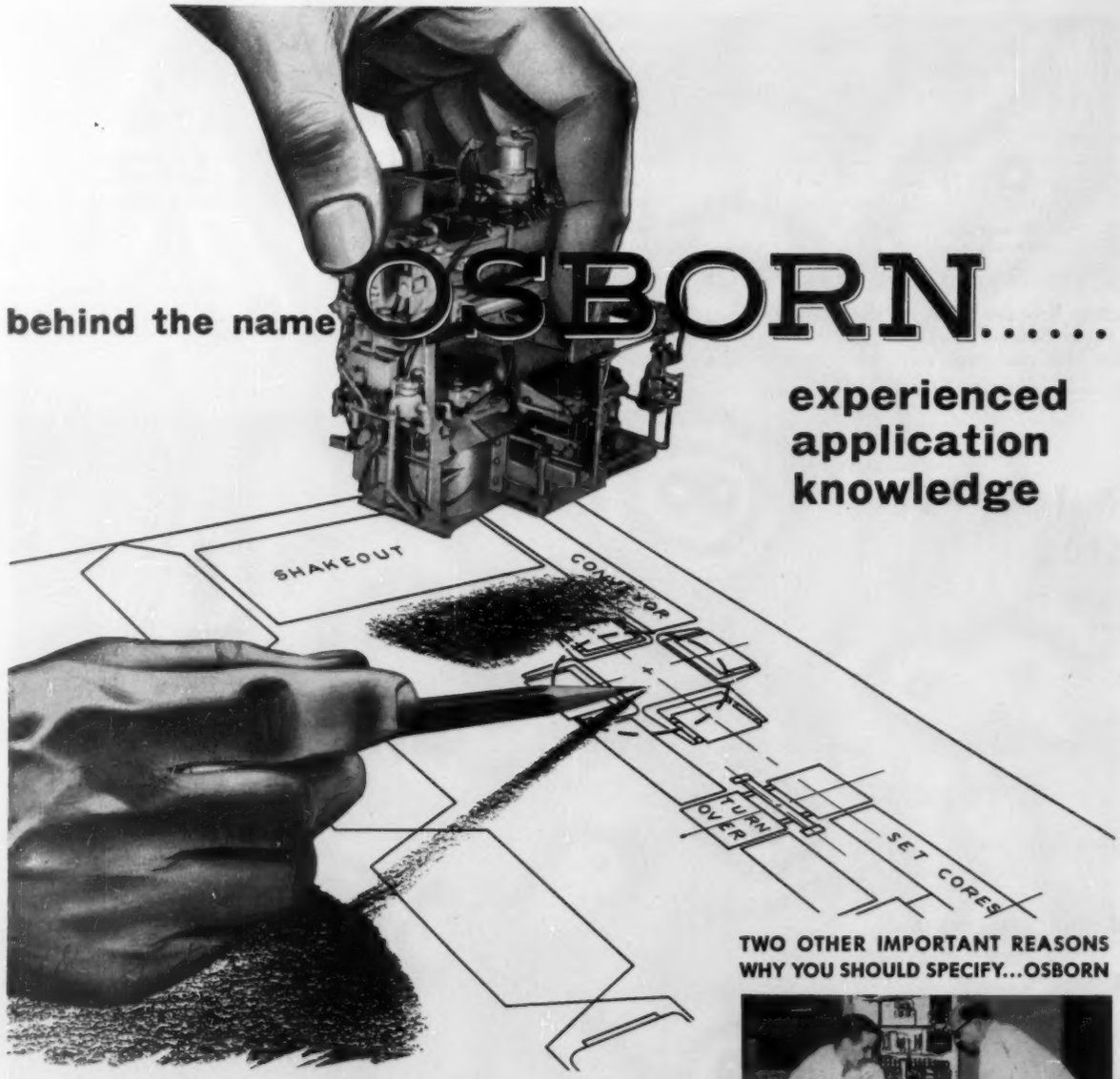
COUNCIL BLUFFS, IOWA
(Across the river from Omaha)
EXCELLENT LABOR HISTORY
EXCELLENT TRANSPORTATION

Complete details of mechanical facilities and area information are available. Write, wire or phone.

S. N. TIDEMAN, JR., EXCLUSIVE AGENT

J. J. HARRINGTON & CO.
TWENTY TWO WEST MONROE STREET, CHICAGO 3, ILLINOIS
Telephone Financial 6-1322

CIRCLE NO. 192, PAGE 19-20



behind the name **OSBORN**.....

experienced application knowledge

Experienced Application Knowledge makes sure you get the most out of automatic equipment

● "How can I apply automation to my production set-up?" Only men *long experienced* in improving foundry methods can give you sound application advice.

"Will I get all the production possible?" Again, Osborn's 50 years of *experience* in both short run and mass-production applications assures peak performance.

Have your operations analyzed by the men who have led the field in the use of automation . . . Osborn application engineers. Call or write *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

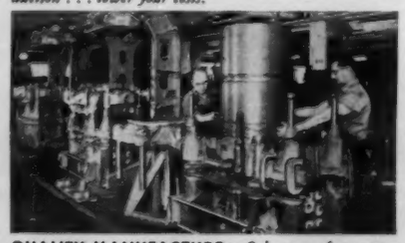
OSBORN *Leader in automation for the foundry*

CORE BLOWERS MOLDING MACHINES INDUSTRIAL ENGINES

CIRCLE NO. 193, PAGE 19-20

TWO OTHER IMPORTANT REASONS WHY YOU SHOULD SPECIFY...OSBORN

ADVANCED ENGINEERING—*Osborn engineering draws on 50 years of practical experience developing methods and designing machinery to increase your production . . . lower your costs.*



QUALITY MANUFACTURE—*Osborn craftsmen are experienced in manufacturing foundry machines that assure dependable performance . . . day after day.*

installation manual. One product is a rigid surface armor; the other is a flexible steel mesh. Both are skid-proof and plenty tough. *Klemp Metal Grating Corp.*

CIRCLE NO. 112, PAGE 19-20

Pipelines for sand transmission are presented in 2-page sheet. The four elements comprising the lines are detailed, with advantages made plain. Sizes range from 2 through 36", with the 4" size usually best for foundry purposes. *Pipe Line Development Co.*

CIRCLE NO. 113, PAGE 19-20

Dust collectors of the wet precipitator type are neatly presented in 4-page "Vacu-Pinger" bulletin. Cutaway and outline views show how they work. Bulletin reports unusually high efficiency as determined by particle count. *Vacu-Blast Co., Inc.*

CIRCLE NO. 114, PAGE 19-20

Foundry engineering service is discussed in 8-page Bulletin 101. The ten-year-old consulting firm tells what it has done and what it can do for foundries. *Lester B. Knight & Associates, Inc.*

CIRCLE NO. 115, PAGE 19-20

Industrial truck brochure highlights 50 years of production, illustrating the first the company made (in 1906) plus many recent models. Many of these are specialty trucks for unusual applications. *Elwell-Parker Electric Co.*

CIRCLE NO. 116, PAGE 19-20

Canvas products described in 4-page condensed list include tarpaulins, decking and roof cloth, drop cloths, bags and baskets, buckets, curtains, stretchers, cuffs, pads, and aprons. *C. R. Daniels, Inc.*

CIRCLE NO. 117, PAGE 19-20

Aluminum alloy practice is told in "How to Melt and Cast Aluminum Alloys," 8-page pamphlet. Aspects covered include furnace selection, sludge, hydrogen, and important principles. *George Sall Metals Co., Inc.*

CIRCLE NO. 118, PAGE 19-20

Vibrating feeders for sand are described in 4-page Bulletin 1000. Feeders are air-powered, have only one moving part, come in selection of sizes. *Cleveland Vibrator Co.*

CIRCLE NO. 119, PAGE 19-20

Foundry equipment of all types are presented in Catalog 564. Everything the company makes—from vibrators,

switches, and feeders through rectifiers, power hammers, and drills is pictured and described. *Syntron Co.*

CIRCLE NO. 120, PAGE 19-20

Detachable coupler called FosterMatic gives quick, automatic plug-in and snap-out coupling for air, oil or grease lines. Catalog G-1 tells how it can be used on reciprocating air tools without lead hoses. *Foster Manufacturing Co.*

CIRCLE NO. 121, PAGE 19-20

Temperature controller that is the electronic type is described in 4-page Specification Sheet S1010-1. This non-indicating device works on the balanced bridge principle; it will function as a single point controller, as a differential controller, or for cascade control. *Minneapolis-Honeywell Regulator Co.*

CIRCLE NO. 122, PAGE 19-20

Wire rope applications are given in 24-page Bulletin DH-129D. Over 120 different types are shown, along with such recommendations are diameters, construction, lay, grade, and core. *Hazard Wire Rope Div., American Chain & Cable Co., Inc.*

CIRCLE NO. 123, PAGE 19-20

V-belt drives are thoroughly detailed in 44-page Bulletin 20P50. Contents include selection tables for these variable speed units, design features, principles, power rating tables, speed ranges, and accessories. *Allis-Chalmers Mfg. Co.*

CIRCLE NO. 124, PAGE 19-20

Non-ferrous ingot and casting alloys information is given in Vol. 12, No. 1-2 of *The Lavingot*. Spec charts give numbers, chemical compositions, mechanical properties, test bar designs. Good enough to keep for permanent reference. *R. Lavin & Sons.*

CIRCLE NO. 125, PAGE 19-20

Melting furnaces shown in 4-page Bulletin 103 are of the single burner crucible aluminum type for oil or gas. Twelve models are pictured, described, and specified. *The Campbell-Hausfeld Co.*

CIRCLE NO. 126, PAGE 19-20

Equipment and installations for the foundry are completely pictured and discussed in 42-page Book 2423. *Link-Belt Co.*

CIRCLE NO. 127, PAGE 19-20

Riddle features a mechanical arm that reproduces the action of hand riddling, and can be swung aside when not in use. Tripod mount is adjustable for height. Riddle can al-

KOLD-SET

PATENT PENDING

NON-DEFORMING
KOLD SETTING CORE
AND MOLD BINDER

CUTS
PRODUCTION
COSTS

- *No Ramming*
- *50% Less Rodding*
- *Controlled Set Times*
- *Uniform Hardness*
- *Reduced Baking Time*
- *Rough Cleaning Eliminated*
- *Accurate Core Dimensions*

By using Kold-Set Binder and Activator with your sand, you get sand that pours freely into the boxes or molds; sets fast at predetermined set times; then bakes out with uniform density and hardness.

When the finished casting is cooled and removed from the flask, the sand, having lost its binding properties, collapses and falls free of the core cavities and mold surfaces. No rough cleaning, only shot blasting is required. Grinding is reduced to a minimum.

Sound interesting? Even remarkable?

You bet it is, and it can drastically reduce the production cost of every casting you make.

1. Controller Body 2. Die
3. Slide
4. Gear Ring 5. Governor Bracket

Above iron castings are shown immediately following removal from the flasks. They were made in Kold-Set molds, using Kold-Set cores, and have finished weights ranging from 150 to 800 lbs.

Castings made in Kold-Set bonded sand show precise dimensions and excellent surface before finishing operations.

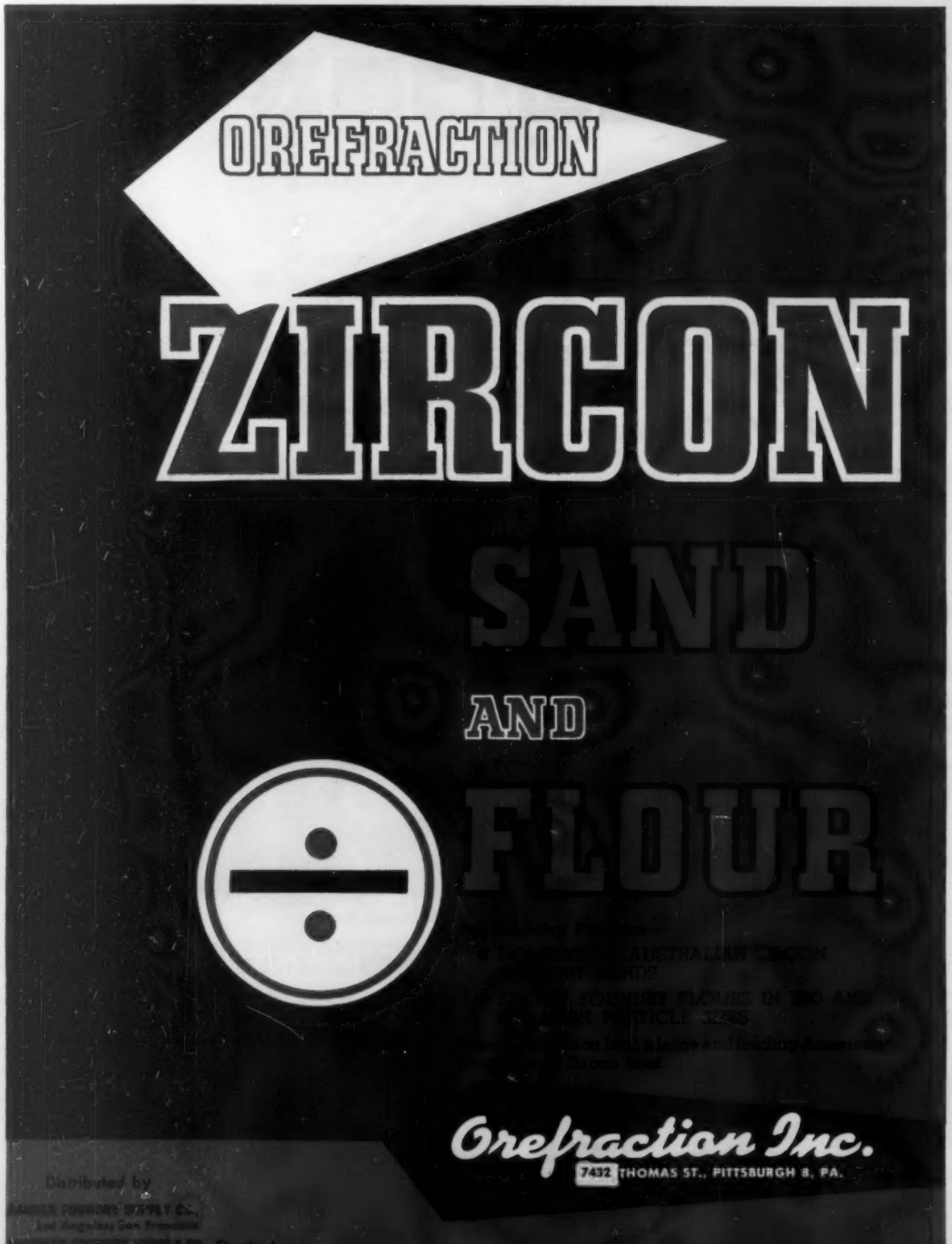
FREE

Send for this bulletin
"QUICK FACTS"

It summarizes step-by-step details and tells how you, too, can save time, money and labor in core and mold making and finishing.

G. E. SMITH, INC.
246-B Washington Road Pittsburgh 16, Pa.

CIRCLE NO. 194, PAGE 19-20



CIRCLE NO. 187, PAGE 19-20

so be used as portable floor sand conditioner. Quarter-hp motor runs it. Bulletin 556. *Martin Eqpt. Co.*

CIRCLE NO. 128, PAGE 19-20

Brass and bronze specifications are cleverly presented in circular slide rule form. Indexing specification number in one little window brings physical properties and chemical composition in other windows. *Roessing Bronze Co.*

CIRCLE NO. 129, PAGE 19-20

Wire rope slings are detailed in a big wall chart in three colors. Chart lists applications, sling diameters, construction features, lifting capacities. *American Chain & Cable Co., Wire Rope Sling Dept.*

CIRCLE NO. 130, PAGE 19-20

Impact pads to reduce shock, vibration and noise from machinery are shown in 4-page brochure. Pads are compressible, strong, and have limited permanent set for long life. *Fabreeka Products Co.*

CIRCLE NO. 131, PAGE 19-20

Sensing devices that can indicate a lack of material supply or flow in handling operations are described in 2-page technical reference sheet 55D. Three models are shown: material level control; blade no-flow alarm; paddle no-flow alarm. Operation and installation are thoroughly described. *Richardson Scale Co.*

CIRCLE NO. 132, PAGE 19-20

Resin-coated sand is the subject of 16-page booklet which outlines the various methods by which sands can be coated with resins. *Durez Plastics Div., Hooker Electrochemical Co.*

CIRCLE NO. 133, PAGE 19-20

Non-ferrous melting practices are discussed in non-technical terms in 8-page pamphlet. All practical information of the Do and Don't type. *The Campbell-Hausfeld Co.*

CIRCLE NO. 134, PAGE 19-20

Industrial spectrographs are shown in 8-page, 2-color Catalog SL-456. These units are high-precision types. Catalog shows actual spectrograms made with the instruments. *Jarrell-Ash Co.*

CIRCLE NO. 135, PAGE 19-20

Combustible gas analysis systems are shown in Data Sheet 10.15-4b. Analyzers have recorders and controllers, and are used for both safety and production applications. *Minneapolis-Honeywell Regulator Co.*

CIRCLE NO. 136, PAGE 19-20

Waste treatment for industrial water is the topic of 4-page Bulletin 315-

NOW users of SAND TRANSMISSION PIPELINES Cut Replacement Time *with* Non-Welded Installations of WELD+ENDS with Clamping Screws

•

Repiacing sand transmission piping lines is quicker, easier with non-welded installations of WELD + ENDS with clamping screws. No threading, no special make-ready is necessary. Cut the pipe—slip the WELD+ENDS on—tighten the clamping screws . . . That's all there is to it.

Non-welded WELD + ENDS are better than flanges, especially where there is frequent replacing of pipe. They can be used over and over again with only the clamping screws requiring replacement.

Where pipeline vibration is severe, clamping screws may be equipped with Nylok lock nuts and Shakeproof washers as shown in the illustration.

Reusable non-welded installations of WELD + ENDS offer continuous savings in down time and repair costs. Write today for further information—also inquire about Plidcowear erosion-resistant pipe. Address Dept. r24

THE PIPE LINE DEVELOPMENT CO.
5700 DETROIT AVE. • CLEVELAND 2, OHIO

CIRCLE NO. 196, PAGE 19-20

92. Contents cover a package unit for removing solids from waste water by settling. *Chain Belt Co.*
CIRCLE NO. 137, PAGE 19-20

Beryllium copper casting alloys are compiled in 12-page catalog. Contents include advantages, alloys, properties, casting and processing techniques. Much excellent reference data is also set forth. *The Beryllium Corp.*
CIRCLE NO. 138, PAGE 19-20

Exhaust hoods for woodworking tools are pictured and described in 12-page Bulletin 270-E3. Contents pinpoint exhaust ventilation for sanders, saws, molders, tenoners, planers, and shapers. *American Air Filter Co., Inc.*
CIRCLE NO. 139, PAGE 19-20

Cranes and monorail systems need electrical equipment to make them run, and that's what's shown in 12-page Bulletin E-156. *Industrial Crane & Hoist Corp.*
CIRCLE NO. 140, PAGE 19-20

casting | through the ages

THE ONLY SURVIVORS
LEFT AFTER INDIANS MASSACRED THE COMPANY ATTEMPTING TO OPERATE AMERICA'S FIRST IRON WORKS AT FALLING CREEK, VIRGINIA IN 1622, ARE SAID TO HAVE BEEN ONE BOY AND ONE GIRL! 347 WORKERS AND THEIR FAMILIES WERE UTTERLY WIPED OUT!
Paul Revere OF REVOLUTIONARY WAR FAME, WOULD TACKLE ANY KIND OF CASTING AT HIS FOUNDRY—PROVIDED THE CUSTOMER LEFT THE NECESSARY PATTERNS!
STOVES UP TO 37 FEET HIGH WERE PRODUCED DURING THE 1600's FROM CAST IRON PLATES HELD TOGETHER WITH IRON FRAMES OR ANGLES.
Odd Bits
The development OF THE MODERN BASIC OPEN HEARTH WAS INSPIRED IN THE 1860's BY A SHALLOW HEARTH REVERBERATING FURNACE ORIGINALLY DESIGNED FOR GLASS MAKING!

"Edco Bottom Boards are permanent equipment in our foundry"

. . . says Olney Foundry, Link-Belt Co., Philadelphia, Pa.

Like other modern mechanized foundries, Olney has come to rely on the durability of Edco Dowmetal Bottom Boards. After 3 years of day-in, day-out use, Edco Boards are still giving maximum production efficiency.

Read what Olney says: "Burning and breakage loss isn't a factor since using Edco Boards. They've helped increase output while cutting production costs and have more than paid for themselves in savings alone effected by substantially reduced replacement costs. Edco Dowmetal Bottom Boards are permanent equipment in our foundry."

Edco Boards help produce castings true to pattern too. Exclusive groove and vented design permits escape of gasses; insures mold stability. Causes for rejects are minimized.

Molders in small, medium and large foundries of all types like handling Edco Dowmetal Boards because they're light (yet strong), stack easily, won't splinter—no breaks, splits or upkeep to worry about. *Your* foundry should be using Edco Dowmetal Bottom Boards.

Write for your free copy of the New Facts File. There's no obligation.

CHRISTIANSEN CORPORATION

210 S. Marion Street • Oak Park 2, Illinois
Phones: MA 6-7330 or EU 3-5050

EDCO DOWMETAL BOTTOM BOARDS
EDCO ALUMINUM CORE PLATES

Please send Facts File including list of 83 standard sizes available from stock.

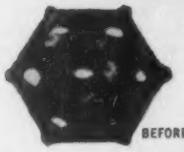
Name_____

Company_____

Address_____

City-Zone-State_____

CIRCLE NO. 197, PAGE 19-20



Steeletts have brought the stamina of steel to grit blasting and are rewriting the story of grit consumption. At Ford Meter Box Co. of Wabash, Indiana, for instance, 75 lbs. of Steeletts do the work of 200 lbs. of chilled iron grit in cleaning and etching non-ferrous castings. This 62.5% reduction in abrasive consumption results from Steeletts' resistance to breakdown.

Chilled iron broke down quickly into fine particles which were drawn off by the dust collector, causing frequent addition of new grit. The Indiana firm also reports Steeletts have produced a better finish on the castings while reducing abrasive consumption.

Wherever an etched finish is required, Steeletts bring savings in cleaning time, abrasive consumption and equipment maintenance. Let them make savings for you.

Write today for Bulletin No. 901-D.

WHEELABRATOR CORPORATION

World's Largest Maker of Airless Blast Equipment and Steel Abrasives

630 South Byrkit Street Mishawaka, Indiana

CIRCLE NO. 198, PAGE 19-20

obituaries

P. T. (Cap) Bancroft, 89, retired foundry superintendent, John Deere Harvester Works, Moline, Ill., died May 14 after being ill for about 3½ months.

Mr. Bancroft was employed by Deere & Co. for 26 years and headed

P. T. Bancroft

the Harvester Works foundry from 1920 until his retirement in 1935.

He resided in Moline the last 25 years and served as chairman of the war price and rationing boards for Moline and upper Rock Island County from August 1942 to August 1943. Mr. Bancroft was an Honorary Life Member of the American Foundrymen's Society and twice served as chairman of the Quad-City Chapter of AFS. In June 1943 he was awarded an "old timers" pin at the AFS Convention in Chicago for 52 years of service to the castings industry.

John F. Smith

John F. Smith, 55, plant manager, Chevrolet-Saginaw Gray Iron Foundry Div., General Motors Corp., died May 26 of coronary thrombosis.

Mr. Smith joined Chevrolet Gray Iron in 1925 after attending New York University. In 1930 he became general foreman, in 1942 was ap-

Q. Which steel shot provides

FASTEST CLEANING
+ LOWEST SHOT CONSUMPTION
+ LOWEST EQUIPMENT MAINTENANCE

= Lowest Cost Cleaning

A. WHEELABRATOR®

STEEL SHOT

Wheelabrator Steel Shot is the only shot that gives you all the qualities vital to lowest COST cleaning and peening. Its high hardness gives super cleaning speed. Its toughness gives extra long life for minimum shot consumption and low maintenance costs. Wheelabrator Steel Shot has so proved itself that it now outsells all other steel abrasives combined. It outsells because it outperforms. Try it today. It's the low-cost answer to your cleaning problems. Write today for your copy of Catalog 89-C.

Now available in new S.A.E. size S-280 shot

WHEELABRATOR CORPORATION

630 South Byrkit Street
Mishawaka, Indiana

CIRCLE NO. 198, PAGE 19-20

125 YEARS IN CHEMICAL SERVICE...

SOAP TO SILICATES

Soap, our first product in 1831, was followed 25 years later by silicate of soda used in our soaps. Silicates became our exclusive interest in 1904.

PQ research in special silicate properties has uncovered and developed new silicates for many valuable uses such as detergents for metal cleaning, sealants for porous castings, binders for cements.

Choose from our 40 products, liquid and dry ($2Na_2O:SiO_2$ to $Na_2O:3.75\ SiO_2$),a silicate for every need.

1831-1956 25th ANNIVERSARY

PHILADELPHIA QUARTZ CO.

1125 Public Ledger Building • Philadelphia 6, Pa.

9 Plants . . . . . Distributors in 70 Cities

TRADEMARKS REG. U.S. PAT. OFF.

PQ SOLUBLE SILICATES / METSO DETERGENTS

CIRCLE NO. 199, PAGE 19-20

FOR CLEAN, DRY AIR

Distributing Line Of Cool Air From Receiver Tank
Vapor Free Air Near Point Of Use
Take Off From Top Of Pipe
Replaceable Desiccant

MURPHY TRIUMPH AA SEPARATOR-FILTER

Sizes: ¼, ⅜, ½, ¾; Weight 30 lbs; Pressures: 0 to 125 psi; Price: $71.00 ea; Desiccant refills $1.00 ea.

After precooling and separating compressed air, this small unit, placed close to the point of use will finish the job of removing last traces of impurities. Where very particular work demands dry air completely free from any trace of oil or vapors Murphy Triumph AA is the answer.

AFTERCOOLERS FOR 10 CFM TO 10,000 CFM—SEPARATORS—TRAPS

JAS. A. MURPHY & CO. INC.

East High Street, Hamilton, Ohio

CIRCLE NO. 200, PAGE 19-20

pointed superintendent in charge of magnesium, in 1945 he was named general foundry superintendent, and finally plant manager in 1952.

Active in the American Foundrymen's Society, Mr. Smith was chairman of the Saginaw Valley Chapter in 1946-47.

Dr. C. R. Austin

Dr. Charles R. Austin, 58, assistant to the president, Meehanite Metal Corp., New Rochelle, N. Y., died May 31 in New Rochelle after a brief illness. He had been associated with Meehanite Metal Corp. since 1945.

Dr. Austin was awarded the Henry Marion Howe Gold Medal for the paper judged of highest merit by the ASM in 1946. He was a member of the American Foundrymen's Society and had written several papers published in MODERN CASTINGS.

William James Maton, Sr., 80, who retired in 1948 as foundry superintendent of Waterbury Farrel Foundry & Machine Co., Waterbury, Connecticut, died May 18 after a long illness. Mr. Maton has held this position for 44 years and at his retirement had completed 58 years with the company.

Active in the foundry industry, he was a past president of the Connecticut Foundrymen's Association and was a long-time member of the National Foundry Association.

Leo Gardner, 43, manufacturers representative in Ohio and western Pennsylvania for various foundry supply companies, died June 15.

Fred W. Elya, 65, retired northeastern district manager, Norton Co., Worcester, Massachusetts, passed away suddenly May 23. He retired July 1 of last year after a career of 43 years selling for the company.

SYNTRON

ELECTRIC VIBRATORS

Assure a free flow of bulk materials through Bins, Hoppers and Chutes

A SYNTRON Electric Vibrator attached to the side of a bin, hopper or chute is all that is needed to guard against material flow bottlenecks. SYNTRON Electromagnetic Vibrators are compact, rugged constructed. 3600 Powerful, controllable vibrations per minute.—Will not damage equipment. Easily installed on your present operation. Sizes and models available for almost any application.

Other SYNTRON Equipment of proven dependable Quality

HOPPER LEVEL SWITCHES | **VIBRATORY FEEDERS** | **SELENIUM RECTIFIERS**

SYNTRON COMPANY

545 Lexington Avenue Homer City, Penna.

CIRCLE NO. 201, PAGE 19-20

local foundry news

H. W. WHEELER, ALLYNE-RYAN FD. CO. FDY. CO.

This meeting of **Northeastern Ohio** was in honor of the "Old Timers." Forty year-men received plaques, 50 year-men received diamond lapel pins. Forty-year-man L. P. Robinson is handling the introductions.

Michigan State University Chapter's Student-Industry Banquet speaker's table seated: Collins Carter, Dr. William Butt, Jack Lan, Ashley B. Sinnett, and Kenneth Priestly.

Penn State Chapter lines up as follows: seated, Co-advisor D. W. Clark, Chairman Reisch, Cor. Sec. Kralles, Rec. Sec. Nelson, and Co-advisor W. P. Winter. Standing are members Arnold, Keller, Albert, Reich, Anderson, Howard, Brooks, Knappenberger, Geiger, Zaborney, Elftherion, and Watson.

H. W. WHEELER, ALLYNE-RYAN FD. CO. FDY. CO.

JACK HEYSEL, E. J. WOODISON CO.

Out-going chairman Leonard Greenfield passes over the gavel to the new chairman of AFS's **Western New York** Chapter, Milton Emery.

Ontario Chapter's paper writing contest paid off for John Allen, Rockwell Mfg. Co., as he accepts first prize check from P. J. Provias, International Nickel.

afs chapter meetings

AUGUST

11 . . Chicago . . *Lincolnshire Country Club, Crete, Ill. Annual Golf Outing.*

11 . . Southern California . . *Lakewood Country Club, North Long Beach, Calif. Annual Summer Outing.*

11 . . British Columbia . . *Horse Shoe Bay, British Columbia. Salmon Fishing Derby.*

SEPTEMBER

8 . . Tennessee . . *Camp Columbus, Chattanooga, Tenn. Annual Outing.*

14 . . Tri-State . . *General interest meeting.*

15 . . Corn Belt . . *Lincoln, Nebr. Annual Picnic.*

Cast Gun Components

Casting, rather than forging, of artillery components has been proved feasible by tests at Watertown Arsenal, U. S. Army. Results are contained in a 26-page report by C. F. Frey. Order PB 111967 from OTS, U. S. Department of Commerce, Washington 25, D. C., price 75c.

Four castings were made experimentally and proved sound by sectioning and other tests. The components were subjected to heat treatment prior to chemical and physical testing. The castings included a high pressure cylinder head for the 120 mm gun, a top cover, bottom cover assembly and block manifold for the 280 mm gun.

Looking . . .

. . . for new production ideas? Circle numers on Reader Service cards (page 19-20) to get more information on products and services described in Products & Processes and For the Asking.

FOUNDREZ 7500 is a very finely powdered thermosetting phenolic resin. You will find that it blends easily, gives uniform shell mold structure and strength in economical sand-to-resin ratios.

When you produce shell molds with FOUNDREZ 7500, you reduce curing cycles. This remarkable RCI resin performs satisfactorily at extremely high oven temperatures, lets you turn out more molds per hour.

While FOUNDREZ 7500 works well in almost all applications, it is especially recommended for tough and intricate jobs where the patterns have a deep draw, and where the sand must flow, fill and bake extra well.

FOUNDREZ 7500-4 is very similar to FOUNDREZ 7500 but is faster setting and intended for use in high speed production. It generally gives a more rigid shell mold than FOUNDREZ 7500.

For large and small parts cast with any ferrous or non-ferrous material, shell molding with FOUNDREZ 7500 and 7500-4 is ideal . . . particularly for long production runs. RCI offers technical help. Get complete data by writing for *Technical Bulletin F-3.*

Creative Chemistry . . . RCI *Your Partner in Progress*

REICHHOLD

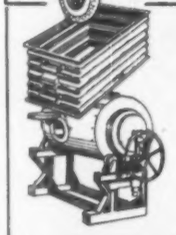
Synthetic Resins • Chemical Colors • Industrial Adhesives • Plasticizers
Phenol • Formaldehyde • Glycerine • Phthalic Anhydride • Maleic Anhydride
Sodium Sulfite • Pentaerythritol • Pentachlorophenol • Sulfuric Acid

REICHHOLD CHEMICALS, INC., RCI BUILDING, WHITE PLAINS, N. Y.

CIRCLE NO. 202, PAGE 19-20

EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD CLEVELAND 10, OHIO



CONVEYORS:

Apron Conveyors:
Midwest — 36″ x 120′
Palmer-Bee 21″ x 5′6″

Mold Conveyors:
1 — Webb heavy duty 356′, 109 cars 32″ x 39″
1 — Link Belt 200′ Long, 35 cars 38″ x 72″

Bucket Conveyors:
3 — 50′ with 8″ x 16″ buckets.

OVERHEAD CRANES:
1 — 3 ton Bedford — 40′ span, 120′ runway.
1 — 3 ton Shepard — Monorail 25 HP, 550 DC.
1 — Chisholm Moore Cupola Charging with 200′ rail 550v 3/60
3 — Pouring off, cab operated, Monorail DC.

TUMBLING MILLS:
60″ x 72″ Ransohoff tumbling type wet cleaning mill, Serial No: 6318, drive 15 HP 3/60/220 and bucket loader 5HP 3/60/220

MAGNESIUM CLEANING CABINETS:
7 — Whirlpool Duplex, 8000 CFM, 100″ wide x 65″ deep x 90″ high. Buffalo exhausters — 7½ HP, 220/440/3/60.

JOLT SQUEEZE STRIP MOLDING MACHINES:
2 — #724 Osborns 2 — Model 24-54D Nichols

ASK FOR OUR COMPLETE LISTING NO. 856

FOR SALE NOW:

In Bellville, Ohio, 10 miles south of Mansfield a complete Gray Iron Foundry with No. 7 Whiting cupola, 18,000 sq. ft. with railroad siding.

WE BUY AND SELL ONE PIECE OF EQUIPMENT OR COMPLETE FOUNDRIES.

WE CARRY ALL TYPES AND MAKES OF FOUNDRY EQUIPMENT IN STOCK.

GUARANTEED USED FOUNDRY EQUIPMENT . . . GLENVILLE 1-1222

M. HOLTZMAN METAL CO.

SMELTERS AND REFINERS
SINCE 1900

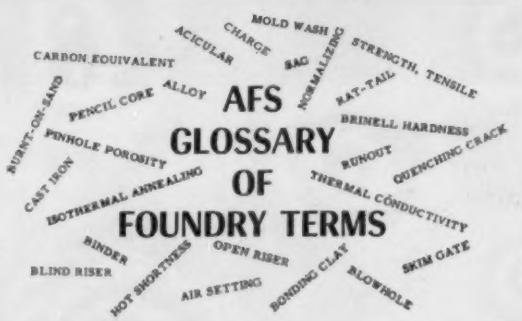
HOLMCO

GUARANTEED Brass, Bronze and ALUMINUM INGOT to your specifications IMPROVED WITH FACTOR "X"!

Send us a sample order! If you want to improve the quality of your finished products at no additional cost . . . let us show you what HOLMCO ingot, improved with Factor "X" can mean to you!

5223 McKISSOCK AVE., ST. LOUIS, MO.
CHestnut 1-3820

CIRCLE NO. 203, PAGE 19-20



Including almost 2000 terms, this book is intended to help standardize the meanings of foundry terms throughout the metal castings industry. In its preparation, reference was made to many presently existing glossaries and dictionaries of scientific and engineering terms. IT IS THE MOST COMPLETE WORK OF ITS KIND and should be at the finger-tips of every member of the metal castings industry. (80 pp. 6 x 9 Paper Bound.)

AFS MEMBERS $.75 NON-MEMBERS $1.25

American Foundrymen's Society
Golf and Wolf Roads, Des Plaines, Illinois

Place my order for ____ copies of GLOSSARY OF FOUNDRY TERMS.

☐ **Remittance Enclosed** ☐ **Send Invoice**

Name_____ **Title**_____
Company_____
Address_____
City_____ **Zone**____ **State**_____

foundry trade news

continued from page 60

Broadway. This office is also headquarters for the firm's international sales.

William Kennedy & Sons Ltd. . . Owen Sound, Ont., gray iron plant has joined Gray Iron Founders' Society.

Rockwell Mfg. Co. . . has started a program which will increase the manufacturing facility of its Delta Power Tool division by 70 per cent.

Welland Iron & Brass, Ltd. . . shop in Welland, Ont., has joined Gray Iron Founders' Society.

Basic Inc. . . refractory manufacturer announced second quarter dividends as follows: $0.25 per share on company stock and $1.4375 per share on preferred stock.

Foote Mineral Co. . . has announced an expansion of production at its Electromanganese Div., Knoxville, Tenn.

Toronto Foundry Co., Ltd. . . Toronto, Ont., plant has joined Gray Iron Founders' Society.

Canton Pattern & Mfg. Co. . . has purchased the Wagner-Schrader Pump Co. through its subsidiary, the Canton Stoker Corp. A $75,000 addition has been built for the new operation.

F. J. Stokes Corp. . . is new corporate name of the former F. J. Stokes Machine Co., Philadelphia.

Belle City Malleable Iron Co. . . has published a folder that details the claims made for the company's electric furnace iron.

International Nickel Co. . . Detroit technical section office is now located at 19842 James Couzens Highway.

Fairbanks, Morse & Co. . . Freeport Works at Freeport, Ill., has joined Gray Iron Founders' Society.

classified advertising

For Sale
Help Wanted,
Personals,
Engineering Service, etc.,
set solid . . 20c per word, 30 words ($6.00) minimum, prepaid.

Positions Wanted
. . 10c per word, 30 words ($3.00) minimum, prepaid. Box number, care of **Modern Castings,** counts as 10 additional words.

Display Classified
. . Based on per-column width, per inch . . 1-time, $15.00; 3-time, $13.50 per insertion; 6-time, $12.50 per insertion; 12-time, $12.00 per insertion; prepaid.

HELP WANTED

WANTED—TIME STUDY and QUALITY CONTROL ENGINEER. Prefer between the ages of 25 through 35. Knowledge of sand laboratory and metallurgy desired but not required. Permanent job in ductile iron foundry in Southeast. Send snap shot and full resume with first letter. **Box C152, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

WANTED—SCHEDULING AND PRODUCTION CLERK. Prefer between the ages of 25 through 35. Other duties include purchasing, inventories, reports, etc. Permanent job in ductile iron foundry in Southeast. Send snap shot and full resume with first letter. **Box C153, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

WANTED—FOUNDRY FOREMAN for Southeastern ductile iron, brass and aluminum foundry. Must have served time as a molder. Prefer between the ages of 25 through 40. Excellent opportunity. Send snapshot and full resume. **Box C154, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

PROGRESSIVE ferrous foundry in Middle Atlantic area desires permanent services of engineering graduate with approximately 10 years foundry operating experience. If interested submit your record and references to **Box C155, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

"NON-FERROUS METALLURGIST" or foundry engineer wanted to improve present aluminum and bronze sand casting and permanent mold practices and develop and introduce new processes. **Box C156, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY SUPPLY SALESMEN Fastest growing supply house in Southeast needs two more salesmen. All National name brand supplies for complete foundry needs. All replies held strictly confidential **Box C158, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY ENGINEERS Well established metal warehouse, handling foundry alloys has need for salesmen to call on iron and steel foundries in Midwest. Salesmen to work out of Chicago and Milwaukee warehouses. **Address Box C111, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

SALES REPRESENTATIVE. Aluminum, Bronze, Magnesium Castings. Should be well versed in foundry practices in Sand, Permanent Mold and Die Casting operations. Develop new territory with good potential. A fine opportunity for a well trained, ambitious person. All replies treated in strict confidence. **OBERDORFER FOUNDRIES, INC., SYRACUSE, N. Y.**

BRASS FOUNDRY SUPERINTENDENT: Must have working knowledge of brass metallurgy, at least 10 years of permanent mold, die cast or sand foundry experience, under 50, salary open. Chicago area. Address reply to **Box C139, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

POSITIONS WANTED

FOUNDRY ENGINEER or SUPERINTENDENT B.S. in chemical engineering in 1938. Eighteen years experience in all phases of founding of brasses, bronzes, and nickel alloys. Know synthetic, natural sand control, metallurgical melting, and scrap control. Can rig patterns, and core boxes for blowing. Five years experience MTM administration in semi-jobbing and production foundries. Will relocate. **Box C151 MODERN CASTINGS.**

MANUFACTURERS REPRESENTATIVE College graduate with Metallurgy background, calling on foundries in New York state, selling Chills and Chaplets, wishes to add allied line. Best references. If interested reply to **Box C159, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOR SALE

FURNACES FOR SALE
10 used Heat Treating Furnaces, and two 7-ton gantry cranes, good condition, priced to sell.
BAER STEEL PRODUCTS, INC.
Box 1428
Boise, Idaho

SMALL, WELL-EQUIPPED FOUNDRY for sale in Eastern Pennsylvania. Has overhead crane, cleaning equipment. Plenty of adjacent land. On railroad. **Address Box C157, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

ENGINEERING SERVICE

EARL E. WOODLIFF,
Foundry Sand Engineer.
Consulting . . . Testing.
14611 Fenkell (5-Mile Rd.)
Detroit 27, Mich.
Res. Phone Vermont 5-8724

SESSIONS ENGINEERING CO.
Consulting Foundry Engineers
Modernization, Processing Layouts
Cost Reduction Quality Control
Product—Machine Design
Architectural Design
One North La Salle St., Chicago 2, Ill.

MATERIALS HANDLING COST REDUCTION
A preliminary survey without charge will determine the potential savings and the cost.
We Invite Your Inquiry
Gemar Associates
CONSULTING
MATERIALS HANDLING ENGINEERS
Greenwich Connecticut
Over 20 years experience

GOT MELTING PROBLEMS?

Solutions to foundry problems often come easier to outside consultants. Get expert help; call for a Semet-Solvay metallurgist . . . he's a practical foundryman whose job it is to help you.

SEMET-SOLVAY DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street — *New York 6, N. Y.*
Buffalo • Cincinnati — Cleveland • Detroit
In Canada: SEMET-SOLVAY COMPANY, LTD., Toronto
Western Distributor: WILSON & GEO. MEYER & CO., San Francisco

For Better Melting

CIRCLE NO. 205, PAGE 19-20

New Oliver Woodturning Lathe cuts large patterns quickly, accurately

The Oliver No. 20 Woodturning Lathe is one of a complete line for pattern shops. It embodies the latest engineering developments. It is available in four sizes to swing 16", 20", 24", 30" over the bed. Standard beds are 8' and 10' long—longer beds furnished as an extra. The regular machines have 8 spindle speeds—16 speeds available on special order. Used in leading pattern shops. Write for Bulletin No. 20.

Oliver makes a full line of lathes and woodworking machinery for pattern shops

OLIVER MACHINERY COMPANY, Grand Rapids 2, Mich.
CIRCLE NO. 204, PAGE 19-20

Free Tear Sheets

of all MODERN CASTINGS articles are available on request. Keep your magazine intact and pass it on for others to use. For free tear sheets, write to Editor, MODERN CASTINGS, Golf & Wolf Roads, Des Plaines, Ill. Please show company connection and your title on tear sheet request.

LITHIUM

...the Miracle Metal

Over 100 Brass & Bronze Foundries Can't Be Wrong!

Last year over 30,000,000 pounds of copper were degasified with Lithium Metal . . . and the volume is constantly increasing. A little Lithium goes a long way. It's a fact that only 0.005% metallic Lithium makes a sounder, more uniform, nonferrous casting . . . in less time with less trouble and at lower cost.

Large size Lithium Cartridges (108 grams) are used for the degasification of large melts of copper including high conductivity metal. Small Lithium Cartridges (2¼, 4½ and 9 grams) are for foundry use in the refinement of high temperature copper, brass, bronze, and nickel-silver castings. Even the salts of Lithium (Carbonate and Chloride, especially) hold great promise for heat treating by reason of their properties in lowering bath melting points.

Is *your* foundry using Lithium? Truly the "ally of alloys," Lithium could hold the same hope for *you*. Look into Lithium. Write for details on actual foundry tests.

... trends ahead in industrial applications for lithium

LITHIUM CORPORATION OF AMERICA, INC.
2605 RAND TOWER
MINNEAPOLIS 2, MINN.

MINES: Keystone, Custer, Hill City, South Dakota • Bessemer City, North Carolina • Cat Lake, Manitoba • Amos Area, Quebec • BRANCH SALES OFFICES: New York Pittsburgh • Chicago • CHEMICAL PLANTS: St. Louis Park, Minnesota • Bessemer City, North Carolina • RESEARCH LABORATORY: St. Louis Park, Minnesota

CIRCLE NO. 206, PAGE 19-20

advertisers and their agencies

Accurate Match Plate Company 8
Agency—Vernon S. Weller Adv.

Allied Chemical & Dye Corp 79

American Foundrymen's Society Book Dept. 67

American Foundrymen's Society Book Dept. 78

Apex Smelting Company .....Back Cover
Agency—Doremus & Co.

Archer-Daniels-Midland Co. 10-11
Agency—The Bayless-Kerr Co.

Beardsley & Piper
Div. Pettione Mulliken Corp. 2
Agency—Ladd, Southward & Bentley, Inc.

Carl Mayer Corp. 59
Agency—Brad Wright Smith Adv., Inc.

Carver Foundry Products Co. 14
Agency—Kreicker & Meloan, Inc.

Catalin Corporation of America 68
Agency—Walter J. Gallagher Adv.

Christiansen Corp. 73
Agency—Marsteller, Rickard, Gebhardt and Reed, Inc.

City Pattern Foundry & Machine Co. 18
Agency—Gray & Kilgore, Inc.

Cleveland Flux Co. 12
Agency—Brad Wright Smith Adv., Inc.

Delta Oil Products Co. 6
Agency—Cormack, Imse, Beaumont, Inc.

E. I. DuPont de Nemours & Co. 17
Agency—Batten, Barton, Durstine & Osborn, Inc.

Eastern Clay Products Dept.
International Minerals & Chemical Corp. 21
Agency—C. Franklin Brown, Inc.

Foundry Educational Foundation 64
Agency—The Wellman-Buschman Co.

Foundry Equipment Co. 13
Agency—Allied Advertising Agency, Inc.

The Federal Foundry Supply Co. 1
Agency—Kasper Advertising

Foundry Services, Inc. 63
Agency—Kight Advertising, Inc.

General Electric Co. 23
Agency—Benton & Bowles, Inc.

Globe Steel Abrasive Co. 66
Agency—Coleman Todd and Associates

Samuel Greenfield Co. 53
Agency—Gotthelf & Weil

J. J. Harrington & Co. 69

Hickman, Williams & Co., Inc. 15
Agency—Saas and Sogard, Inc.

Holtzman Metal Co. 78
Agency—Milton Sharp, Adv.

International Minerals & Chemical Corp. 21
Agency—C. Franklin Brown, Inc.

Jeffrey Mfg. Co. 5
Agency—The Griswold-Eshleman Co.

Chas. C. Kawin Co. 66

Keokuk Electro-Metals Co. 52
Agency—Waldie & Briggs, Inc.

Lectromelt Furnace Company
.....Inside Front Cover
Agency—The Griswold-Eshleman Co.

Lindberg Engineering Co. 50
Agency—Don Colvin & Co., Inc.

Link-Belt Co. 9
Agency—Klau-Van Pietersom-Dunlap Assoc.

Liquid Carbonic Corp. 65
Agency—Fletcher D. Richards, Inc.

Lithium Corporation of America, Inc..... 80
Agency—Keystone Advertising, Inc.

Magnaflux Corporation 22
Agency—Stoetzel & Associates, Inc.

Mexico Refractories Co. 16
Agency—Carl Lawson Adv. Co.

Modern Castings 60

Jas. A. Murphy & Co., Inc..... 75
Agency—Clint Leap Inc. Adv.

National Metal Abrasive Co..... 15
Agency—Saas and Sogard, Inc.

Oliver Machinery Co. 79
Agency—Webb J. Van Dyke Adv.

The Osborn Mfg. Company..... 70
Agency—The Griswold-Eshleman Co., Inc.

Orefraction, Inc. 72
Agency—Smith, Taylor & Jenkins, Inc.

Pangborn Corp. (Malleabrasive Div.)..... 7
Agency—Van Sant, Dugdale & Co., Inc.

Pettibone Mulliken Corp. 2
Agency—Ladd, Southward & Bentley, Inc.

Philadelphia Quartz Company 75
Agency—The Michener Company

The Pipe Line Development Company.... 73
Agency—The W. N. Gates Co.

Pittsburgh Crushed Steel Co..... 66
Agency—Coleman Todd & Associates

Reichhold Chemicals, Inc. 77
Agency—MacManus, John & Adams, Inc.

Semet-Solvay Div. 79

G. E. Smith, Inc..... 71
Agency—Smith, Taylor & Jenkins, Inc.

States Engineering Corp. 66

Frederic B. Stevens, Inc....Inside Back Cover
Agency—Zarker Adv. Co.

Syntron Co. 75
Agency—Servad, Inc.

Thiem Products, Inc. 51
Agency—Ken Seitz & Associates, Inc.

Wedron Silica Co. 4
Agency—Armstrong Adv. Agency

Wheelabrator Corp. 74
Agency—The Jaqua Co.

This index is published as a convenience to the readers. While every care is taken to make it accurate MODERN CASTINGS assumes no responsibility for errors or omissions.

Economical, but efficient, no!

NEW PRODUCT IDEAS FOR THE CO_2 PROCESS

A number of proven products for the CO_2 process, that will improve cores and molds, cut costs and promote casting quality are now being manufactured by Stevens.

If you are now using, or are interested in, the latest foundry development, the CO_2 (carbon dioxide) process, write today for the new Stevens Technical Bulletin FA-130,

"STEVENS PRODUCTS FOR THE CO_2 PROCESS."

This bulletin gives complete information on the subject of release agents, core pastes, mudding compounds, core and mold coatings, collapsibility additives and binders for the CO_2 process. Write *FREDERIC B. STEVENS, INC., 1804 Eighteenth Street, Detroit 16, Michigan.*

BRANCHES: BUFFALO • INDIANAPOLIS • NEW HAVEN

FREDERIC B. STEVENS INCORPORATED EVERYTHING FOR A FOUNDRY DETROIT 16, MICHIGAN

CIRCLE NO. 207, PAGE 19-20

Outstanding Machinability . . . All-Purpose Economy

APEX Z-33 ALUMINUM ALLOY

A quality all-purpose alloy that gives you outstanding economy on the production line—that's Apex Z-33. Developed by Apex to combine better than average mechanical properties, uniform casting characteristics and exceptional machinability, Z-33 has been thoroughly proved in both foundry and final application. Its as-cast properties are right for most castings, it can be heat treated for highly stressed castings, and it has excellent dimensional stability with an aging treatment. Apex Z-33 takes anodizing and other chemical and electrochemical finishes, responds beautifully to buffing and polishing.

In your profit-minded operation there's a definite place for the versatile, economical applications of Apex Z-33.

Send without obligation for information covering complete specifications and properties of Apex Z-33.

APEX SMELTING COMPANY

CHICAGO • CLEVELAND • LOS ANGELES

modern castings

CIRCLE NO. 208, PAGE 19-20